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JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXVI. No. 918.] LONDON, DECEMBER 14, 1880. [32ND YEAR. Price 6d.

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BY
OXIDE OF IRON.

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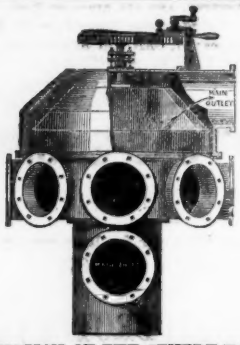
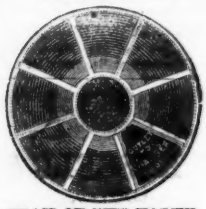
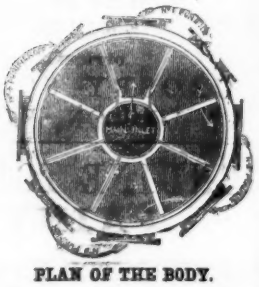


ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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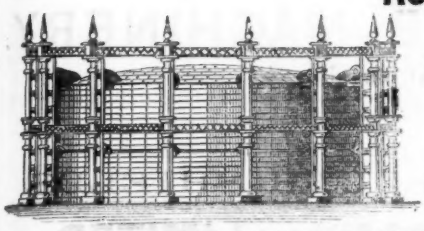

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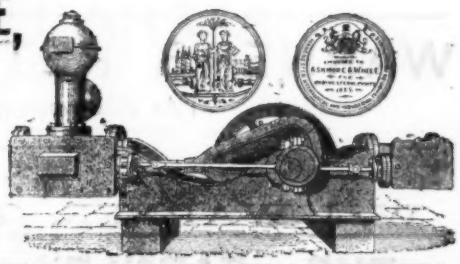

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[*As Illustrated and Described in the* JOURNAL *for May* 4.]

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The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*
The advantages attending its use are—

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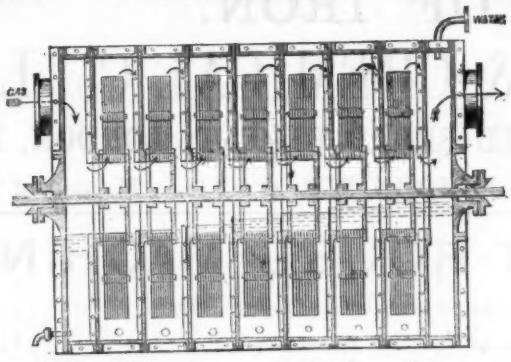
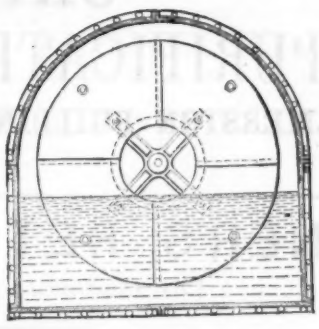
PATENT "STANDARD" WASHER-SCRUBBER COMPANY.





These Machines contain from 3200 feet to 65,000 feet of Wetted Surface.

The Special Merits of this Washer are as follows:—That it is not necessary to reduce the temperature of the gas to 60°, or thereabouts, to make it effective; and that as no tar is retained in it, the illuminating power is not reduced as in Tower Scrubbers. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas as it ascends. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine, as well as a very large quantity of carbonic acid and sulphuretted hydrogen. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

Messrs. Kirkham and Hersey. *The Gaslight and Coke Company, Beckton, North Woolwich, June* 8, 1880.

Gentlemen,—I enclose you some particulars of the working of your Washers here, and I intend having some more experiments made, as just now we are working the first Washer with liquor and the second with water. Of course the fact of our having ordered two more, in addition to the four which we have in use, is a sufficient indication of my opinion of the value of the Washer. (Signed) G. C. TREWBY.

Messrs. Kirkham and Hersey. 25, *Palace Chambers, Bridge Street, Westminster, S.W., July* 19, 1880.

Dear Sirs,—The "Standard" Washer which you supplied for use at the Vauxhall station of the Phœnix Gaslight Company afforded me entire satisfaction. It was designed to remove the Ammonia from 3 million cubic feet of gas per day, and during the past winter it did so with a good working margin to spare. It is as excellent now in workmanship as in design, and is well worthy the general acceptance with which it appears to be meeting. I am, faithfully yours, (Signed) CORBET WOODALL.

Messrs. Kirkham, Hulett, and Chandler. *The Gaslight and Coke Company, York Road, King's Cross, Jan.* 14, 1879.

Gentlemen,—In reply to your inquiry, I am pleased to say the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, it takes out every particle of Ammonia, while purifying more Gas than it was intended to do. I enclose particulars of a week's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c., (Signed) JOHN CLARK, Engineer.

Messrs. Kirkham and Hersey. *Phœnix Gaslight and Coke Company, Office, Greenwich, S.E., Dec.* 19, 1879.

Gentlemen,—In accordance with my promise that I would inform you as to the working of the "Standard" Washer erected by you here in June last, I now write to say that we are passing through it 100,000 cubic feet per hour (the quantity for which it is made) direct from the Condensers, "bye-passing" the whole of our Scrubbers, which, not being needed, have been standing still since the "Standard" Washer was put in use. It seems as though the Washer more effectually removed the Ammonia when taking the full quantity of gas than less; as, at the present time, at the sixth chamber (there being eleven in all) not a trace can be discovered either by turmeric or acid litmus paper. The difference in pressure between inlet and outlet is only ten-tenths of an inch. I need scarcely say, after the above, how perfectly satisfied I am. (Signed) P. J. WATES, Engineer.

Messrs. Kirkham, Hulett, and Chandler. *Corporation of Birmingham, Gas Department, Saltley Works, May* 23, 1879.

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Messrs. Kirkham and Hersey. *The Leeds Corporation Gas-Works, Meadow Lane, Aug.* 14, 1879.

Gentlemen,—In reply to your inquiry of yesterday's date, I have pleasure in stating that the item appearing as income derivable from Ammonia in my estimate of revenue for current year is not an exaggeration. Our average income from Ammonia is 2s. 8d. per ton of coals carbonized, but at the works where your invention is in use we derive not less than 3s. per ton. Since the introduction of efficient Scrubbers at our works the greater yield of this product (now twice as valuable as coke to us) is such that the cost of Apparatus for its extraction can be wholly paid for out of from nine to twelve months gains. I am, Gentlemen, yours faithfully, (Signed) H. WOODALL, Engineer.

Dukinfield, Denton, and Haughton Gas-Works, Dukinfield, July 31, 1880.

Messrs. Kirkham, Hulett, and Chandler, Limited, 59, Palace Chambers, Westminster.

Gentlemen,—We commenced the use of your "Standard" Scrubber on the 1st of February last, and from that date to the end of June we had passed 168½ tons of Ammoniacal Liquor of 6° strength into the tar well, as indicated by a liquid-meter. This liquor being sold at 19s. per ton realized £160, which was a clear gain to us of 1s. 0½d. per ton of Coal carbonized, due to the use of your Washer, in addition to which there was a saving in the cost of purification.

During the above period we had removed the Ammonia from 28½ million feet of gas, and as we make 81 millions yearly, the saving, at the same rate, would be £460 per annum. The Apparatus (without foundations and connections) cost £420, so that it will pay for itself within twelve months of its erection. I am, yours truly, (Signed) HARRISON VEEVERS, Engineer and Manager.

Messrs. Kirkham, Hulett, and Chandler, Limited. *Leominster Gas and Coke Company, Limited, March* 20, 1880.

Gentlemen,—In reply to yours of the 18th inst., we have a 3½-horse power "Otto" Silent Gas Engine; this drives by belt a 5000 feet per hour Beale's Exhauster, Tar, Liquor, and Water Pumps, and your "Standard" Washer-Scrubber. The engine is easily managed, and is sufficient for nearly double the work it has yet had to do. I think a 1 to 1½-horse power engine amply sufficient for a Washer for 7000 to 10,000 feet per hour.

With regard to your Washer-Scrubber, it causes a very decided improvement in the illuminating power of the gas—say 1½ candle; it is now 17 candles by No. 1 Sugg's Argand burner. Clear water supplied at the rate of 10 gallons per ton of coal comes out 5° to 6° Twaddel, and we find the purifiers much freer from tar, and requiring less lime. Our Working Manager says your Washer is the best machine that ever came into the works.

Yours truly, (Signed) JOHN F. SOUTHALL.

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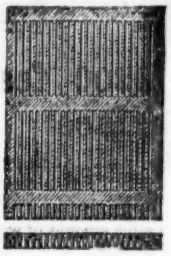

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SCRUBBERS FILLED WITH BOARDS,
On our approved principle, for the extraction of Ammonia.
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BRADDOCK'S PATENT COMPENSATING GAS-GOVERNORS;
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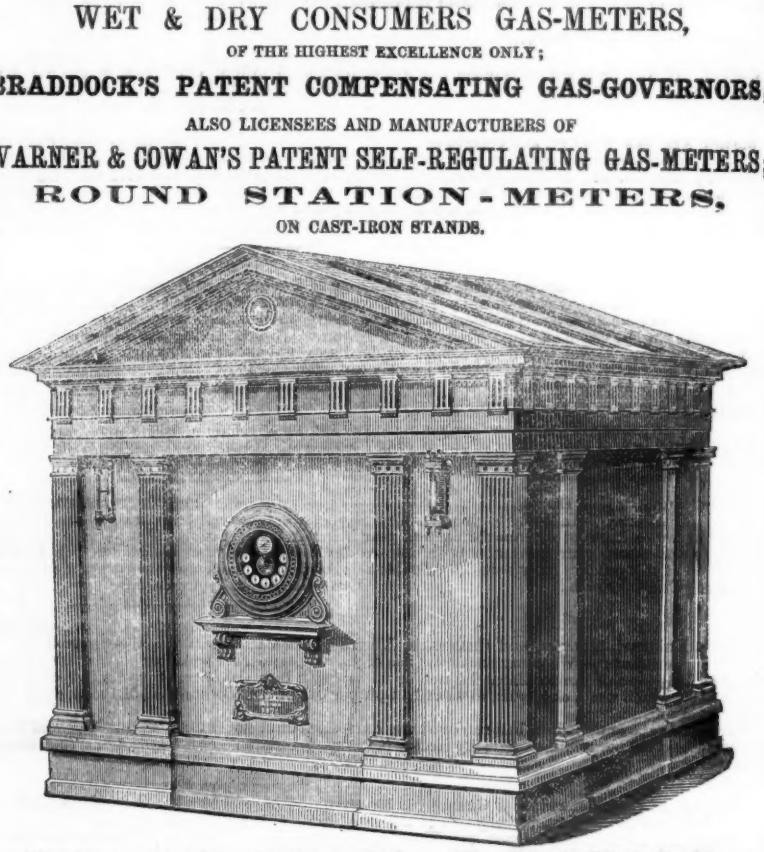
WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;
ROUND STATION-METERS,
ON CAST-IRON STANDS.



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WITH PLANED JOINTS.
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Home and Foreign Orders promptly attended to.
All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.
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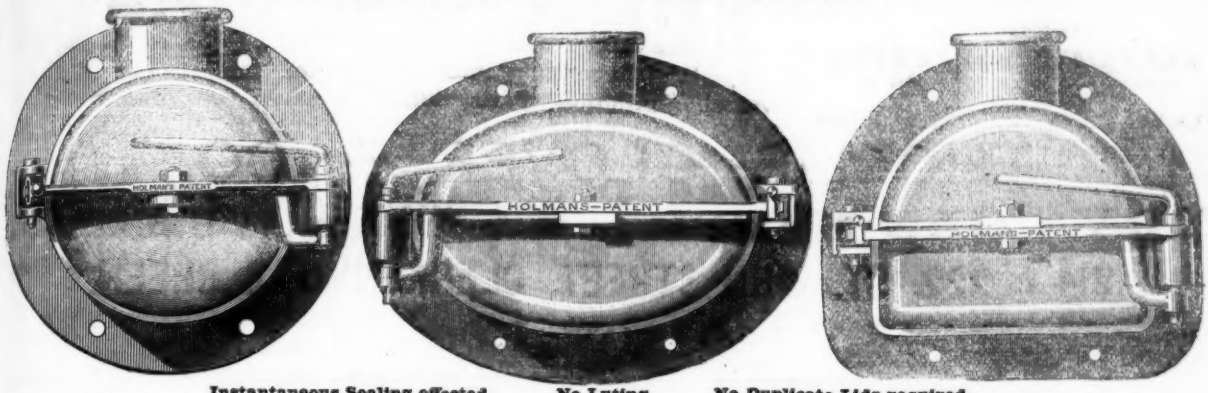
SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and Self-Sustaining Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Morton's Patent Retort-Lids are in use in nearly all the Principal Gas-Works in the United Kingdom and the Colonies; also on the Continent and in the United States of America. They are now made of the

SAME FORM OR SECTION AS THE RETORT. (See Illustrations above.)

Engineers preparing Specifications of New Works will be furnished with Dimensions of Stock Patterns, together with Approximate Weight and other data on application.

HUNT'S
EQUILIBRIUM DIRECT-MAIN GAS GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight & Coke Co. (19), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Leicester, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

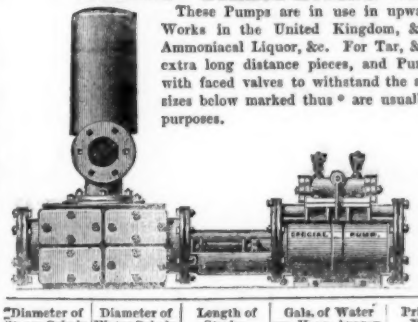
MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

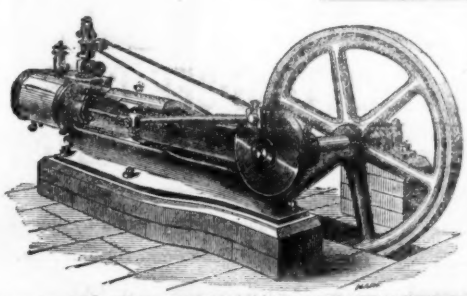
THE
"SPECIAL" DIRECT-ACTING STEAM-PUMP.

These Pumps are in use in upwards of one hundred Gas-Works in the United Kingdom, &c., pumping Water, Tar, Ammoniacal Liquor, &c. For Tar, &c., they are provided with extra long distance pieces, and Pumps are entirely of iron, with faced valves to withstand the action of the liquid. The sizes below marked thus * are usually kept in stock for these purposes.



The quantities delivered of Tar should be taken about two-thirds that of water.

Diameter of Steam Cylndr.	Diameter of Water Cylndr.	Length of Stroke.	Gals. of Water per Hour, Approx.	Prices for Water.	Prices for Tar and Ammoniacal Liqr.
*3 in.	1¼ in.	9 in.	450	£16 0 0	£17 0 0
*4 ,,	2 ,,	9 ,,	815	18 0 0	19 0 0
*5 ,,	2¼ ,,	12 ,,	1,250	21 0 0	22 10 0
*5 ,,	3 ,,	12 ,,	1,830	22 10 0	24 0 0
*6 ,,	3 ,,	12 ,,	1,830	25 0 0	26 10 0
*6 ,,	4 ,,	12 ,,	3,250	30 0 0	31 10 0
6 ,,	5 ,,	12 ,,	5,070	35 0 0	36 10 0
*7 ,,	5 ,,	12 ,,	5,070	40 0 0	41 10 0
7 ,,	6 ,,	12 ,,	7,330	45 0 0	46 10 0
*8 ,,	6 ,,	12 ,,	7,330	50 0 0	52 0 0
10 ,,	6 ,,	12 ,,	7,330	60 0 0	62 10 0
10 ,,	8 ,,	12 ,,	13,000	75 0 0	77 10 0



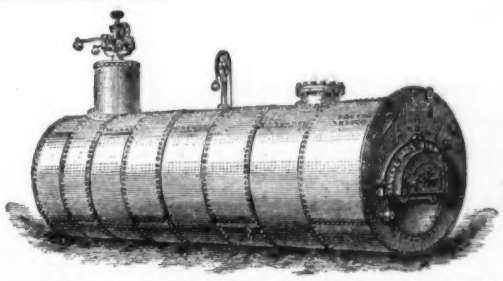
TANGYE'S HIGH-PRESSURE STEAM-ENGINE,

NEARLY 4000 IN USE.

The Design, Workmanship, and low prices of these Engines have called forth universal approval.

Nom. H.P.	2	3	4	6	8	10	12	14	20	25
	£28	£37	£44	£68	£86	£111	£122	£133	£185	£215

Including Governor and Feed Pump. Variable Expansion extra.



CORNISH, LANCASHIRE, "THE KESTERTON," VERTICAL, AND MULTITUBULAR STEAM-BOILERS OF SUPERIOR QUALITY ALWAYS IN STOCK.

This Department having been greatly extended and furnished with the most approved Boiler-making Machinery and Tools, T. B. & H. are prepared to supply all kinds of Steam-Boilers with great facility at lowest current prices.

Also Makers of IMPROVED HYDRAULIC HOISTS, TRAVELLERS, CRABS, CRANES, PULLEY BLOCKS, HYDRAULIC AND SCREW LIFTING JACKS, LATHES, PUNCHING AND SHEARING MACHINES, And all other Descriptions of Tools, &c.

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London, 1862. New York, 1863. Paris, 1855. London, 1862.

Dublin, 1865 Paris 1867.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

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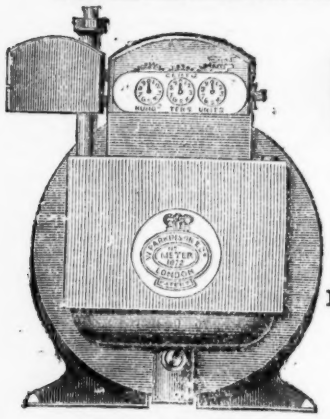
THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816)



WET & DRY METERS,

STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

SOLE AGENTS FOR

FOULGER'S PATENT SEAL UNIONS & CUTTING-OFF CAPS.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."

The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

J. W. & Co.—*Your letter arrived too late for insertion in to-day's* Journal. *It will appear next week. Shall be glad if next time you communicate you use one side only of the paper.*

Received.—*Vol. III. of "A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali, with Collateral Branches." By George Lunge, Ph.D., F.C.S., &c. London: J. Van Voorst.* 1880.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 14, 1880.

Circular to Gas Companies.

As the time approaches when the Employers Liability Act will come into operation, signs multiply to show that masters and men are painfully feeling their way in anticipation of its probable effects. Nobody seems to know exactly what changes may be expected in industrial organizations when the new law becomes an obtrusive fact; and in all probability it will be some time before either employers or workmen perfectly realize the value of their fresh responsibilities or privileges. To this uncertainty must be ascribed the tentative character of much of the proposed action in contemplation of the impending alteration in industrial politics. Fortunately, we are not directly concerned with any of the more burning questions respecting the operation of the Act, such, for example, as are even now agitating the minds of railway operatives and miners. There is a strong feeling on the part of these classes of the labouring population, among whom the victims of accident are known to be many, against the Act being construed merely as a measure for providing pecuniary compensation for personal injury to servants. They consider that any arrangement whereby their employers can insure themselves against mere loss of money caused by accidents to workmen is in contravention of the spirit of the Act, which they contend was meant to render accidents less frequent, by fining the employer heavily for their occurrence. From this point of view it is evident that financial operations, by way of a general insurance, based on actuarial calculations of the past recurrence of injury to persons employed in any particular occupation, are distinctly open to the imputation of tending to perpetuate a state of things which might be ameliorated, if those most concerned in controlling the conditions under which accidents happen were made personally responsible for them. On the other hand, there is nothing in the Act to forbid employers taking advantage of formal insurance, either on their own account or in concert with others; and there can be no doubt that action of this kind would help to make the workman's compensation more secure. It is also conceivable that litigation would be diminished by the matter, in case of dispute, being practically made referable to a third party; although this is a phase of the difficulty to be expected in the practical working of the law, which is almost too debateable for the very vaguest prognostications.

As we have said, however, considerations of this kind, which almost presuppose a daily toil attended by great risk, together with a total severance of the interests of employers and employed, are somewhat foreign to us. Gas-works are not hazardous places of employment. It would be difficult to name an occupation wherein more workmen grow to a hale old age than in the manufacture of gas. The labour in most departments of a gas undertaking, though moderately severe, in the sense of requiring sound, able-bodied men for its performance, is neither dangerous to life or limb nor exhaustive of vital power. Many men pass their working years in the service of a Gas Company, even in the retort-house, with no more damage than a burnt hand or a gathered finger, while in other branches they are rarely subject to more than the casual injuries common to outdoor workmen on the ground. And it cannot be said that the general relations of the men with their employers are such as to cause much fear that the law will form a bone of contention between the two parties. In all cases it will probably be easy to arrive at a *modus vivendi* for the prevention of any possible unpleasantness which may arise when masters and men undertake to work separately under the Act, instead of together. In large establishments particularly it will be comparatively simple to combine the employers insurance with the workmen's provident club. There is, of course, nothing to compel the workman, in case of injury, to go upon the club instead of proceeding against his employer; but he would be unable, in any case, to claim from both, and the fact that belonging to the club is generally one of the conditions of employment, with the further consideration that claiming from the club funds would be less troublesome and more profitable in many ways than the more belligerent course, would keep the employer practically safe.

The immunity of Gas Companies servants from personal injury is strikingly shown by the history of the Superannuation and Sick Fund established in 1855 by the South Metropolitan Gas Company, for the benefit of their workmen. From the period of its commencement until the close of last year, when a general inquiry into the working of the fund was instituted, not a single case has occurred of a subscriber, in the execution of his duty, receiving such injury as to render him incapable of work, and thereby throw him on the benefit of the fund. This fund is otherwise remarkable. The subscription is threepence weekly, entitling the subscriber to a pension of ten shillings per week when past work. The Company have contributed to the fund, roughly speaking, about as much as the members have paid, and, as a result, the fund has at least thirty per cent. of assets in excess of all contingent and emerged liabilities. The gross amount of the Company's contribution has never exceeded £200 per annum, so that the declining years of their old hands have been made comfortable at a small cost over and above the money collected from the men themselves.

Although, in the past, this particular Company would have escaped all liability under any penal Act of the nature of that under notice, for the all-sufficient reason that there have been no injuries, it is plain that it would be imprudent even for them to expect a continuance of their fortunate experience, Therefore the old superannuation fund will be remodelled. and made the basis of the new insurance fund. It is satisfactory to be assured that even the extreme amounts by way of compensation mentioned in the Act, will be amply covered by a premium on a very small scale. When threepence per week per head is found, in one example, an ample subsidy for meeting all the charges for workmen's pensions and allowances, the burden of an additional and separate accident fund must surely be small.

It must not be overlooked that in all cases it is essential that employers and employed should combine to make the best of the inevitable. Only in this way can the operation of the Act be made beneficial or even unobjectionable. A policy for employers which consists in holding aloof, or attempting to terrorize workmen from availing themselves of the Act, will most assuredly fail to shield those who adopt it from loss of money and repute, while it will furnish a strong argument for the use of agitators in demanding a measure more stringent still.

The gas supply of Stone, Staffordshire, appears destined to force itself upon public notice. The present state of

affairs in that locality is not considered satisfactory by the inhabitants, for reasons not altogether due to the action of the local Gas Company. The Company are applying to the Board of Trade for a Provisional Order, by which they hope to strengthen their position, and among other conditions to be included in the Order, they seek to obtain a maximum price for gas a trifle higher than that actually charged at present. This is only common prudence, but it nevertheless alarms the consumers, who somehow do not see that the maximum legal charge and the ordinary price fixed by commercial considerations are two distinct things. The chief cause of public disquietude is, however, the late and present policy of the Local Board. Last year the Board made application to the Local Government Board for authority to erect works and supply gas in competition with the Company. The application was not successful; but heavy expenses, amounting to a rate of about 1s. 6d. in the pound, were incurred, and this charge swells the town rate now payable to such an abnormal figure, that a local Hampden has arisen, in the person of Mr. Martin Smith, the General Manager of the North Staffordshire Railway Company, who flatly declines to pay anything to the Board, on the ground that the cost of the gas agitation was incurred without the consent of the ratepayers, and was consequently without legal sanction. This gentleman is decidedly the hero of the hour in his own neighbourhood, and his defiance of the constituted authorities is rapturously applauded by the majority of the inhabitants of Stone, who are naturally not averse to having the common cause defended by any one who is imbued with sufficient public spirit to fight the Board at his own expense. Mr. Smith also proposes to carry the war into the enemy's country by commencing negotiations with the Company on behalf of the consumers, independently of the Board, in the belief that the ground will be cut from under those oppressors of the poor (ratepayers) by the demonstration that better terms may be made with the Company, without incurring any expense, than the Board can claim to have effected at a perfectly ruinous cost. We wish the enterprising railway manager every success in his last-named efforts, for he will at least have an instructive interview with the Directors of the Company, and may become satisfied that they do not seek more extensive powers than are enjoyed by the majority of Gas Companies in the kingdom. We shall, moreover, await with interest the result of Mr. Smith's personal struggle with the Board on the great rate question.

The Bristol Sanitary Authority have a very curious way of doing business. Being dissatisfied with the tenders submitted by the Gas Company for lighting the public lamps, they recently decided to ask the Directors to reduce the price, and if they were unsuccessful, to refer the matter to arbitration. So far well; the Authority are justified in seeking to obtain the best terms possible; and, if a clear case can be made out for the necessity for arbitration, it is both the lawful and sensible course to be taken. But probably with the intention of frightening the Company into submission to any terms, the Sub-Committee on Lighting persuaded the Authority at a recent meeting to sanction the expenditure of £500 in experiments in electric lighting. How much electric lighting the Committee expect to get for this sum does not transpire, nor does the proportion borne by the same amount to the cost of the gas supplied to the public lamps. The Quay was suggested as a suitable scene for the proposed experiments; but again we fail to see how taking from the Gas Company such a portion of this particular area as may be lighted by electricity for £500, will tend to make the latter charge less for lighting the tortuous streets and alleys of the rest of the old city. When gas has reason to fear electricity in the illumination of such places as Bristol, the game will be almost over; but at present the picturesque though tangled plan of the place decidedly favours the Gas Company.

The Town Council of Newport (Isle of Wight) are so dissatisfied with the working of the average meter system for street lighting, of which they have had a few years experience, that they have decided to discontinue it for the ensuing year, and have offered to make a contract with the Gas Company at fixed rates, by which they will, they anticipate, save 8s. 8d. per lamp per annum, as compared with the cost of the present mode of lighting. Whether the Company will accept the offer remains to be seen; but if the Council were satisfied that, under the average meter system, they only paid for the gas actually consumed, the burden of proving the necessity of reduction lies with them. If the price of gas was too high, the Council might have asked the Company to lower their rate; but to throw over an arrangement of which so much was expected, and thereupon to ask for the same light at a less cost without assigning cogent reasons for such a change of plan, is a rather inexplicable proceeding.

The officials of the Alliance and Dublin Consumers Gas Company and of the Dublin Tramways Company have achieved a practical success for their plans for lighting tram cars with gas of the ordinary kind as supplied to the city. The gas, compressed at starting, is contained in reservoirs (situated underneath the seats in the cars) of sufficient capacity to serve for a double journey. It has been shown that cars so lighted are much more cheerful and comfortable than when lit by oil in the old way. All the Dublin tram cars are, it is said, to be immediately fitted for the new method of lighting, and when this is done the condition of night travellers therein will be considerably ameliorated. It is difficult to see that any greatly increased consumption of congratulated on their evident determination to extend and gas will be experienced by the Company in consequence of this novel development of business, but they are to be popularize the use of gas.

The paper on gas-retorts read by Mr. J. Chadwick before the Manchester District Institution of Gas Engineers at their last meeting, and printed in another column, was principally concerned with the comparative merits of brick-built and moulded clay retorts. The subsequent protracted discussion was also confined in the greater part to the same question. It cannot be said that anything very new transpired on this occasion, for nothing was exemplified by the remarks of the various speakers more than the power of custom. The majority of the advocates of brick or moulded retorts, if not exactly "born so," were still, from the persistence with which the kind of retort best and longest known to each speaker was by him considered to be the absolute superior, so wedded thereto, that it almost looked as if a man experienced in the use of one kind could not bring himself to see much good in any other. To do the determined adherents of the two forms of fire-clay retorts justice, it may, however, be conceded that the difference between them is mainly one of practice only.

Mr. Walker's paper subsequently read was in its essence a plea for the tower scrubber, and was spirited and well-timed. The author was supported by all of his hearers, for there did not appear to be a friend of any other kind of scrubber present, although the discussion wandered a little in the direction of washers, for it is sometimes difficult to distinguish between the two classes of apparatus. Mr. Walker is a believer in the policy of utilizing ammoniacal liquor as a purifying agent, which is quite a separate business from the mere elimination of the ammonia from gas. He appears to have attained much success in this direction, for which, according to him, the tower form of scrubber is best suited.

Purchase of the Newtownards Gas-Works by the Town Commissioners.—It may be remembered that in October last we gave some particulars of the negotiations that had been entered into between the Newtownards Town Commissioners and the local Gas Company for the purchase by the former of the Company's works and plant. We understand that the Commissioners have made an offer, which the Company have accepted, to take over the undertaking at the exact sum at which Mr. A. Silverthorne, who has throughout acted for the Commissioners, valued it—viz., £9386 10s., and which is £4877 less than the amount of Mr. G. Anderson's valuation on the part of the Company. The Commissioners now propose to borrow £10,000 to enable them to complete the purchase. It is gratifying that the consideration shown by both parties to Mr. Silverthorne's valuation will save the expense of an arbitration.

The Gas Supply of Stone.—A public meeting was held at Stone last Wednesday, with reference to the question of the supply of gas there, and, as the notice convening the meeting stated, "to consider the powers proposed to be taken by the Gas Company, and to adopt such course as might be deemed advisable in the interests of the town." After some discussion, in the course of which it became very evident that the members of the Town Council had lost much of the confidence placed in them when elected, the following resolution was passed by acclamation, and a Committee of eight gentlemen appointed to carry it into effect:—"That a Committee of ratepayers and gas consumers be appointed by this meeting to examine the proposed Provisional Order of the Gas Company; to meet the Directors of the Company; and to endeavour to obtain, by friendly arrangement, such modifications in the scheme as they may consider desirable or necessary, in the interests of the town."

Birkenhead Corporation Gas Supply.—At the meeting of the Birkenhead Town Council on Wednesday last—the Mayor (Mr. W. Laird) in the chair—the minutes of the Gas and Water Committee were brought up. They included a lengthy report from Mr. T. O. Paterson, the Corporation Gas Engineer, on the present condition of the gas-works, and on the extensions desirable to be made in them. On Mr. Rawcliffe moving the confirmation of the minutes, Alderman Willmer moved an amendment proposing the postponement of the adoption of the report, and the reference of the plans of the extensions contemplated to some eminent engineer for his opinion. Mr. Wilkinson seconded the amendment, which Mr. Rawcliffe characterized as frivolous, urging that delay in the matter would deprive a part of the town of its gas during the ensuing winter. On a vote being taken, the amendment was negatived by 40 votes against 4. The proceedings of the Committee were then confirmed.

Water and Sanitary Notes.

We have reason to believe that Sir William Harcourt is busily engaged in preparing his London Water Supply Bill for the coming session. From what we observe, we are inclined to think there is not much prospect of that "direct representation" for which Mr. J. Beal and his friends have so strong a predilection. In respect to the measure generally, we may give the Home Secretary credit for a certain amount of receptiveness, but no harm would accrue to the practical nature of the coming Bill if the Home Office would condescend to receive a little light from the Water Companies themselves.

Mr. F. H. Fowler has been making certain remarks at a recent meeting of the Strand District Board of Works, which serve to show that he has some appreciation of the magnitude of the task which would devolve on any new authority constituted to take charge of the Water Supply of the Metropolis. To be responsible for the supply to each one of six hundred thousand houses, including a population of four and a half millions, and to supervise the whole army of officials connected with the enterprise, is something more than Mr. Fowler thinks could be properly undertaken by a single administrative body. He favours, therefore, the idea of a new Regulation Act, forgetful, perhaps, in some degree, that one already exists, and that the Metropolitan Board of Works, of which body he is a member, is, to a large extent, responsible for the fact that in some points the law does so very little good. It is accordingly a question whether a new Regulation Act is really wanted and, if wanted, whether there is any authority—except it be the Local Government Board—who will co-operate with the Water Companies in carrying it out. Mr. Fowler has an idea of a change in the mode of charging for the water supply. He thinks it would be well that there should be a general rate for public purposes, and a domestic rate for houses, while all beyond (such as baths and business requirements, now charged for specially) should be paid for by meter. With regard to the domestic rate, he proposes that it should be graduated, so as to fall less heavily on small property. But we scarcely think Mr. Fowler will be able to devise any practicable scheme which will make the water-rate fall more lightly on small property than it does now. We believe it is just in this particular that the present system offers peculiarly easy terms. If the pressure falls anywhere, it is on the larger class of property, and especially on warehouses. As a matter of fact, the wealthy classes are made to pay for their water supply on the principle that it is part of a great sanitary system, in which the payment is not necessarily proportioned to the immediate personal advantage. If the mode of charging for the water supply undergoes any extensive change, we shall expect to find small property more heavily weighted, to the relief of those classes who can better afford to pay, and who at present contribute to the cost of the water supply after the same manner as they pay for sewerage and drainage. For the sake of the general good, water should be made as free as possible to the poorer classes, and this is the plan which now prevails in London.

In harmony with the remarks of Mr. F. H. Fowler at the Strand District Board, we observe that the Select Committee of the Lambeth Vestry who have taken the Water Question into their consideration, have prepared a report to be laid before the Vestry on Thursday next, proposing that the Companies should be placed "under improved regulations, "with greater control on the part of the local authorities." There is notice of an amendment—"That no legislation will "secure public confidence, and be satisfactory to the water "consumers, unless it secures a representative water autho- "rity based on the direct representation of the ratepayers." Of course the equity of all this depends very much on what we are to understand by "improved regulations," and what are the powers to be possessed by the "water authority." Power given to the Vestries or anybody else to do as they please with property belonging to other parties, would be subversive of private rights, and would simply be confiscation in another form. Setting up a "standard of quality," as proposed by Lieut.-Col. Bolton, might be a very good regulation, and there might be some useful amendments in other respects. But "local authorities" and parochial politicians need not expect that Parliament will make them omnipotent over the Water Companies. At the same time the idea of regulation instead of purchase or competition shows a more reasonable spirit than has occasionally been manifested.

The speech of Alderman Knight, the Chairman of the Southwark and Vauxhall Water Company, at the half-yearly meeting of Shareholders, on Thursday last, contained some very pregnant facts. Another instance is afforded of the accuracy of the statements put before Sir W. Harcourt's Select Committee by the late Mr. E. J. Smith. Where this much-abused gentleman reckoned on an increase of £3500 in the Company's income, the actual increase has exceeded £4000. The heavy law and parliamentary expenses forced upon the Company in connection with the question of the Metropolitan Water Supply last session has perceptibly operated in reduction of dividend, so far damaging the Company without benefit to the public. In consequence of the Government proceedings, the Company's own Bill had to be abandoned, involving a loss of £1478. In addition, the Company had to defend their own interests before the Select Committee, the outlay on that account amounting to £1024. Expenses were also incurred in opposing the proposed sewage farm of the Lower Thames Valley Main Sewerage Board. Altogether the law and parliamentary expenses were £2780 in the last, and £2763 in the previous half year, thus making a total of nearly £6000, or about one per cent. on the ordinary stock. The extent to which the parishes seek to raise the Company's assessment was also referred to by the Chairman as a heavy drawback. But for the law expenses, the Shareholders would now be receiving nine instead of seven and a half per cent.; and but for the increase in their assessment, they could have as much as ten per cent. next year, whereby, the limit of dividend being reached, the Company could direct their attention to a reduction in the water-rates. Despite all difficulties, the Company are in a prosperous condition, and the Chairman, in reference to the fate of the provisional agreement made with Sir R. Cross, is warranted in saying "the public have yet to learn "and to regret the bargain they have lost."

The half-yearly report of the Directors of the Grand Junction Water-Works Company, to be laid before the meeting of Shareholders to-morrow, calls attention to the "altered state "of things" which has arisen since the negotiations for the purchase of their works were broken off. When those negotiations were commenced, the Company were burdened with a recent outlay of £124,000, incurred in the construction of important new works, from which they had received but little benefit. The tide has now turned, and whereas the annual increase of profit calculated upon by Mr. E. J. Smith was £5250, the actual increase for the last financial year proves to be £7553. The Directors further state they have thought the present "a fitting time" to urge strenuously, and as far as possible to enforce, in all new building districts and estates, the adoption of the constant supply, and arrangements have been made for carrying out this system forthwith in respect to several building estates now in course of development, of which a list is given. We may, therefore, hope that one well-worn sentence will speedily disappear from Lieut.-Col. Bolton's monthly report, which has told us from time to time that "all the Companies are moving in the matter, and giving "constant supply under the Metropolis Water Act, 1871, in "a portion of their districts, except the Grand Junction "Company." A dividend at the rate of seven and a half per cent. is to be proposed at the meeting; but a little more might have been paid had it not been for those law and parliamentary charges which have arisen out of the recent agitation on the question of purchase.

Abolition of Meter-Rents at Guildford.—The Secretary of the Guildford Gaslight and Coke Company (Mr. W. Longworth) has given notice to the consumers, on behalf of the Directors, that, on and from Sept. 30 last, and until further notice, meter-rents will be discontinued, and meters be supplied to consumers free of any charge for hire. It is further stated that consumers who heretofore have purchased meters from the Company, may, by arrangement, re-sell them.

Sales of Gas and Water Shares.—On Wednesday, the 1st inst., Mr. J. Banks sold by auction, at Folkestone, 14 £10 shares in the Folkestone Water Company; ten of them fetching £19 15s. per share, and four £19 10s. per share.—On Thursday, the 2nd inst., Mr. J. G. Sharp offered for sale by auction, at Bradford, some shares in the Clayton, Allerton, and Thornton Gas Company. 39 original £10 shares, all paid up, were sold for £18 10s. per share; 22 "A" shares of £10, fully paid up, realized £15 10s. per share; and 15 "B" shares of £10 (£5 each paid up) were knocked down at £8 5s. per share.—On Wednesday last, Messrs. Fox and Bousfield offered for sale at the Auction Mart, Tokenhouse Yard, E.C., 170 fully paid £10 shares in the Danish Gas Company. The Company was formed in 1854 to supply the principal cities and towns of Denmark with gas, for which purpose it has secured concessions. Works have been constructed in many of the most important towns, and the consumption annually increases. The capital of the Company is £150,000, in 15,000 shares of £10 each, and the dividend has been at the rate of 8 per cent. for the past ten years. The shares were put up in 17 lots, and were all sold at a premium of 5s. per share, the total amount realized being £1742 10s.—Last Tuesday some shares in the Rochester, Chatham, and Strood Gas Company were sold by auction at the following prices:—Fifty £50 "A" shares for £3070, and 35 £8 10s. "B" shares for £628, these realizing rather more than £17 18s. each.—On Wednesday, shares in the Newport (Mon.) Water-Works Company were sold in lots of five each at the following prices:—£20 7s. 6d., £20 15s., £20 15s. 6d., £20 17s. 6d. (two lots), and £21. Two £10 preference shares in the same Company—6 per cent. dividend—sold for £16 each.

THE ENCOURAGEMENT OF GAS CONSUMPTION.

ALTHOUGH gas manufacturers have always regarded a large yearly increase in the quantity of gas sold as a proof of the vitality of their business, and such increase invariably suggests congratulations to those who enjoy it, yet it is doubtful whether, until very recent days, more than a small minority have used any special efforts to secure it. The sale of good gas at the lowest price consistent with fair dividends has usually resulted in growth sufficient to satisfy the producers, and the attraction to proprietors of increasing a good investment by subscribing capital for extensions has not been sufficient to provoke novel or definite exertion. Works have generally been laid down with not too large a margin of producing power, and when they are really profitably employed it is not unusual to find some reluctance to expend further considerable sums which may for a time be relatively less remunerative. To "let well alone" is the sentiment governing such cases. Without staying to inquire further why Gas Companies in the past have done little to foster and develop the uses and applications of gas, we may direct attention to two or three reasons of comparatively modern origin which have already had an influence in creating a more enterprising spirit, and which should prove a still stronger impulse in the same direction.

The first of these arises from the gradual transfer of the undertakings of Gas Companies to municipal bodies. To so large an extent has this change obtained, that the policy pursued by Corporation Gas Committees must, and does now greatly influence that of Companies, instead of being, as until very lately, simply matter for more or less friendly criticism. Now, in the case of a Corporation acquiring the business of a prosperous and well-conducted Gas Company—and the great majority of those hitherto transferred have been of this character—the hope of gain by the transaction is based almost entirely upon the anticipated increase of business to be done. The annual charge against the undertaking for interest on the purchase-money is usually fully equal to that required for the payment of the maximum dividends of the Company purchased. The greater economy with which the Corporation can raise money, as compared with the Company, only enables it to pay the necessary premium, and start at no disadvantage on this head, despite the large increase in the nominal amount of capital employed. Allowing to the Company that it has honestly observed the conditions of the Acts by which it was regulated, no profit beyond that necessary for the payment of dividends has been earned, or, if earned, it has been returned to the consumers in the form of a reduction in the price of gas. Again, it is manifestly unsafe to build much upon the chances of still greater economy in production, especially in these times of exceptionally low prices of all the principal materials used in gas manufacture. An increase in the price of gas for the mere purpose of creating a balance of profit, is, of course, out of the question. We repeat, therefore, that the only legitimate hope of gain to a Corporation acquiring the business of a well-managed Gas Company lies in the certainty that the business will increase, and the gain should be proportionate to such increase. Clearly, if this be so, there is imparted to a very large and steadily increasing proportion of the gas undertakings of the country a great stimulus not felt before, and the influence of which will extend beyond its own wide borders.

Another reason for the increased activity that has become apparent is one which it may be anticipated will long continue its beneficent operation. The electric light has imported into the domain of gas makers the novel and stimulating idea of rivalry. No doubt, gasmen generally are sincere in the conviction they express that this rivalry is not a serious one in the sense of threatening a displacement to any large extent of gaslight by electricity. No one, however, denies that the competition is very real on the points of efficiency and attractiveness in many situations. The electric light has also created a desire for illumination more brilliant than that hitherto generally accepted as satisfactory, and there has been a considerable and praiseworthy effort made to prove that gas is capable of meeting the new requirements. We recently described the superb display of the capabilities of gas for illuminating large spaces designed for the Corporation of Birmingham by Mr. Hunt. This exposition—in many respects the most successful of its kind—is one of a number which, inaugurated in London two years ago by the late Phœnix Company, aided by Mr. Sugg, have since that time brightened the "after-dark" appearance of every considerable town in the kingdom. We need not remind our readers that the contest for supremacy in this territory is still to be fought out, and no sense of security as to the issue should be allowed to diminish its thoroughness. Gas should be enabled to win by its own merits, rather than by trusting to the supposed inherent defects of its rival. A sad example of "how not to do" this is afforded constantly to the large numbers of observant and interested persons who visit the electric lights on the Thames Embankment and Waterloo Bridge. The gas lights in these thoroughfares are probably the worst of their kind in London. Waterloo Bridge especially has for years past been given over to the most wretched burlesque of gas lighting ever witnessed in public. The comparison between a flame consuming from four to six feet of gas per hour, and an electric light of, say, a hundred candles, is sufficiently trying to the former at its best; but only those who have seen it can realize how painful it is when the gas is at, not *its* worst, but the worst of bad burners and dirty lamps. Amid general signs of a desire to improve upon the work of the past, these blots are probably useful as pointing one direction in which advance should be made. It may be reasonably hoped that having served as examples of inefficiency for so long, these lamps may soon be reformed from their bad pre-eminence to fair examples of efficient lighting. The illustration we have used is, no doubt, exceptional; but it has been named because we regard it as not only unwise but unfair to gaslight that it should be so unnecessarily disparaged. Generally there is an evident determination to pursue an opposite policy, and this is the reason why we hail the sentiment of rivalry which has arisen, and from it anticipate increasing advantage to gas industry.

Another inducement to a policy of enterprise and a desire for growth, we need hardly say, has been furnished by the abolition of a fixed maximum dividend, and the substitution of the sliding scale. This modern revolution in gas legislation has proved, and must increasingly prove a strong stimulus in the desired direction, and to this extent, at least, it has our cordial approval. As with Corporations under the conditions we have described, so with Companies working under the sliding scale, and having a normal price which is not favourable, but simply just, this advantage will be found: The increased dividend hoped for will be obtained more surely from enlarged operations and increased sale than from any other source.

These, then, are some of the special reasons which are acting at the present time to excite a greater interest in the development of the uses of gas. They are added and supplemental to the desire which has always prevailed among those who are proud of their manufacture to see it have as wide a scope as possible, and from the number and diversity of the causes thus operating much may be expected. We shall return to this subject in our next issue, and point out some of the directions in which the development may be hastened, as well as the advantages which will be reaped from it.

THE annual dinner of the members of the Society of Engineers will take place to-morrow (Wednesday) evening at the Guildhall Tavern, Gresham Street, E.C., at six o'clock precisely.

SOCIETY OF ENGINEERS.—At the meeting of the Society of Engineers on Monday, the 6th inst.—Mr. J. Bernays in the chair—a paper was read by Mr. Frank W. Grierson, Mem. Physical Society (London), &c., on "The National Value of Cheap Patents," in which he showed that the stamp duties on a patent in this country, lasting 14 years, are £175, while those on an American patent, lasting 17 years, are only £7. A table was given of the applications and grants of the British and American Patent Offices during the last ten years, from which it could be seen that our £50 stamp duty at the third year kills 70 per cent. of the patents granted, and that our £100 duty at the seventh year kills 20 per cent. more, leaving only 10 or 11 per cent. to complete the full term. The effect of these duties is that while on Dec. 31, 1879, there were in this country only 15,755 patents in force, in the United States there were more than 200,000, not including designs. The States thus have thirteen times more patents in force than we have, and therefore make thirteen efforts towards advancement for every one that we make. During the last ten years 22,868 British patents have been crushed out by these duties, but an American patent once granted lasts the full term without further payment. The result of this is seen in our enormous import of American goods, and in the continuous flow of our skilled artizans to America. From a comparative table of average results for the last ten years it was seen that the applications for patents in the United States and Great Britain respectively are 19,770 and 4496, and the grants are 13,355 and 2980. The average cost, to the inventor, for one patent, including patent agent's charges, is there only £19, but here £190. Only one patent is granted in this country to three that are granted in the States, after allowing for the difference in population; and the duties on one patent here would pay those on twenty-five there. It might therefore be fairly said that the British inventor is handicapped 25 to 1 in favour of the American, and it is to be remembered that in handicapping the inventor we handicap the nation. Mr. Grierson drew attention to Mr. Stansfeld's proposed reduced stamp duties—viz., on application, £2; on complete specification, £3—total, £5; besides an annual tax of £1. Provisional protection to be for one year, and patents to last 21 years. After remarking upon the advantage of official technical examination of applications, the author pointed out that it is impossible to calculate the enormous indirect loss the nation suffers from our present excessive patent stamp duties, which drive abroad and stifle a large proportion of that inventive faculty upon which alone we are dependent for holding our place among the nations, and which might, if not so hampered, save a considerable number of lives now annually lost in preventible accidents, and might find employment for many who are now unable to obtain work, and whom, in consequence, we have to support.

THE OXIDATION OF SULPHUR IN COAL GAS.

In a paper read before the Manchester Literary and Philosophical Society last month, Mr. H. Grimshaw repeated the charges so often urged against sulphur in coal gas. Mr. Grimshaw was led to frame his indictment through the discovery of a drop of sulphuric acid in the globe which surrounds a gas-jet in his hall. He says:

An accidental, somewhat peculiar, but very practical demonstration of this fact [the formation of sulphuric acid] recently came under my observation, which I thought might be of some little interest to the Society. On the interior of the glass globe surrounding a gas-jet in the hall of my house I had frequently noticed the presence of drops of condensed liquid. The jet being near the outer door, and the globe consequently exposed to a rather cold current of air, I merely considered it to be drops of water formed by the burning hydrogen of the coal gas, and condensed on the cold surface of the glass. I noticed, however, that when the glass became heated through the turning on of a larger flame, the moisture did not, as it ought, according to all reasonable expectation, evaporate. I was curious enough to take down the globe, wipe out a few of the drops on slips of paper, and rinse the rest off with water, which I preserved. Having my suspicions, from the rather oily appearance of the drop, I warmed the slips of paper a little, and immediately obtained a very fine reaction for sulphuric acid, by the copious blackening and charring of the paper in those places where the liquid had touched it. I then applied the usual chloride of barium test, and obtained a plentiful precipitate of sulphate of barium from the washings of the globe; thus showing, of course, that the oily drops were literally nothing but tolerably strong oil of vitriol.

The formation of sulphuric acid under these particular conditions is a fact well known to chemists. The sulphur contained in coal gas is burnt to sulphur dioxide—itself a harmless gaseous body at ordinary temperatures. It dissolves readily in water, and the solution of sulphurous acid thus formed, if placed in a current of hot air, becomes partially oxidized to sulphuric acid, the greater part of the sulphur dioxide escaping into the air. It is well known that in the Referee Sulphur Test, the products of combustion of the coal gas, mixed with air and gaseous ammonia, are passed through a long cylinder containing a number of wet glass balls. The sulphur dioxide is dissolved by the water, together with ammonia, whereby a solution of ammonium sulphite is formed—a body more stable than sulphurous acid itself. The hot air passing over the ammonium sulphite slowly oxidizes it to ammonium sulphate. The cylinder is of such a size that all the sulphur dioxide is "fixed" and oxidized on the wet surfaces. The conditions for complete oxidation are—(1) a large wet surface to condense the sulphur dioxide; (2) presence of ammonia, or other alkali, to "fix" the sulphurous acid; (3) the passage of hot air over the alkaline sulphite so fixed. On the other hand, when the products of combustion escape directly into the air, or are drawn through an excess of pure cold water, no sulphuric acid is found among them. The glass globes round gas-flames, and the glass vessels hung over gas-flames to catch the soot, play the part of the Referees condenser for a short time every evening. When the gas is lighted, some steam, produced by the burning hydrogen, is condensed on the glass surfaces as long as they remain cold. This deposit of water absorbs sulphur dioxide, produced by the burning of the sulphur in the gas, and thus forms a solution of sulphurous acid. This solution, partially neutralized, it may be, by ammonia from the gas, is subjected to a current of hot air, which oxidizes some of the sulphurous acid to sulphuric acid, while the rest evaporates as water and sulphur dioxide. A minute drop of sulphuric acid is thus left on the glass, and becomes the nucleus of a fresh deposit of sulphurous acid when the gas is lighted next day. By this means, in the course of several months, a large drop of sulphuric acid may be produced. But, because sulphuric acid is thus gradually formed on a body held close to a coal-gas flame, it does not necessarily follow that sulphuric acid is gradually formed on the pictures, books, and furniture of a room in which coal-gas is burnt. As a matter of fact, there is no deposit of moisture on the walls and furniture of an ordinary room when the gas is lighted. The atmosphere of a room, even on a wet day, is not saturated with moisture; that is, it can hold more aqueous vapour in suspension. Now, when gas is lighted in the room, the temperature is raised. By the rise of temperature, the saturation point is also raised, so that although aqueous vapour is poured into the room from the gas-jets, the atmosphere does not become saturated with moisture; on the contrary, the room becomes relatively *drier*—especially those parts near the ceiling, which are said to be the chief victims of the sulphur.

By a simple experiment any one can satisfy himself on this point. Take a wet and dry bulb thermometer into an ordinary room, and read the difference in level of the two mercury columns. Light the gas, and place the thermometer two or three feet from the ceiling. It will be found that the difference between the two columns gradually increases. In other words, the atmosphere is farther from the saturation point, or is relatively *drier*, after the gas is lighted. Of course, any substance quite close to the gas-jet, such as the globe, shade, or brass-work, will condense a little water on its surface before it gets warmed up. In this case the aqueous vapour from the gas-jet is caught before it has time to diffuse itself throughout the air in the upper part of the room. Besides the very small quantity of sulphuric acid which is formed and collected in the manner we have described, and perhaps a further small quantity which is formed in porous substances, such as the decayed calf bindings of books, and the carbonaceous deposits from smoky gas-flames, the rest of the sulphur is wholly swept away as sulphur dioxide in the ordinary ventilation of the room. But Mr. Grimshaw asserts that the whole of the sulphur is converted into sulphuric acid in the room in which the gas is burnt. He remarks:

Say that the gas which I burn in my house contains no more than 10 grains of sulphur per 100 cubic feet. This means 100 grains, or about a quarter of an ounce (about) per 1000 cubic feet. I find that I burn on an average, through five or six jets per evening, 8900 cubic feet per quarter. This contains 890 grains of sulphur, which is equal to 2670 grains of sulphuric acid (H_2SO_4); so that I turn into the atmosphere of my house, mostly into one room, nearly 6 ounces of sulphuric acid in three months. This is 24 ounces, or 1½ lbs. per annum. Now, if I had been burning the Leeds gas, of the quality which has recently been subjected to a good deal of criticism, and which is stated to contain 40 grains per 100 cubic feet, then I should be subjecting the contents of my house to the action of 1½ lbs. of vitriol per quarter, or 6 lbs. per annum. In many cases, certainly in those cases where the contents of the room are most liable to damage, the above amount of gas—namely, that from five or six lights—is given off into the atmosphere of one room.

Almost all the objects in the upper parts of a room are susceptible to damage by the vapour of sulphuric acid. I do not take into consideration the presence of sulphur dioxide, for it is almost impossible that this body could escape conversion into sulphuric acid in a very short space of time, in the presence of oxygen, the vapour of water, and heat. Ceilings, cornices, wall-papers, pictures (with their cords or chains, and frames), books, and so on, are all objects which are susceptible to the corrosive action of the vapour of sulphuric acid, and there cannot be much doubt that in a longer or shorter time they will all suffer from the presence of the sulphur in gas where the latter is burned in any quantity.

Now the experiments of Mr. Lewis T. Wright—noticed in the JOURNAL of the 13th of April last—show that no sulphuric acid is formed in the flame itself. The sulphur escapes into the air as sulphur dioxide. Unless it is held in solution *close* to the burner, by water deposited on the shade and fittings before they are warmed up, the dioxide is spread throughout the air of the room, of which it forms about the three millionth part by volume; and since the air of a gas-lighted room is below the saturation point, the sulphur dioxide is not condensed, but passes into the outer air with the carbonic acid and hot air by the usual ventilation exits. In the trial at the Royal Observatory related by Mr. C. Heisch, the products of combustion of a coal-gas flame were passed into a zinc chimney. By this means diffusion was prevented. On cooling down, in its passage up the metal chimney, the steam was, of course, condensed on the zinc, and the deposit of water so produced took up the sulphur dioxide, forming a solution of sulphurous acid, which, just as in the Referees apparatus, was placed in a current of hot air, and, therefore, under exactly the right conditions for rapid oxidatino.

It happens sometimes that, owing to a leakage in the water-pipes or roofing, water exudes from the walls of a room, and produces a permanent wet patch on the wall-paper. Such a wet surface will absorb sulphur dioxide from burning coal gas, and this will gradually undergo oxidation. The damp discoloured paper will then be found impregnated with sulphuric acid. But we doubt whether the injury inflicted by the moisture itself on the fabric is not greater than that wrought by the acid it produces.

The evidence as to injury done to bookbindings in a gas-lighted room is conflicting. Calf-bound books are found to suffer most; but whether the injury is done by the formation of sulphuric acid on the calf, or by the heat of the room only, is at present a moot point. Professor Ripley Nichols—whose paper, reprinted in the JOURNAL,* we recommend to the careful attention of Mr. Grimshaw—shows that sulphuric acid or acid sulphate of ammonia is found in the rotten bindings of books, especially Russia and calf bindings, in larger proportion than could be accounted for by the alum used in the paste and the acid retained from dressing the leather in dilute sulphuric acid. But when calf-bound books have been exposed for a long time to a high temperature, the calf becomes porous, owing to disintegration, and in this state becomes very hygroscopic. It is, therefore, probable that the disintegrated substance takes up water in which sulphur dioxide is condensed and then oxidized, and the sulphuric acid found in the decayed calf is the *effect*, not the *cause* of the decay.

CALVERT'S MECHANICS ALMANAC AND WORKSHOP COMPANION FOR 1881.†

This is a handy little publication, wherein a calendar forms the skeleton, which is filled out by a mass of instructive and entertaining matter, somewhat in the "Mechanics Institute" vein. We are accustomed to find, in publications of this class, appealing ostensibly to artizan readers, a dreary compilation of perfectly frowzy cuttings and elementary "original" articles hashed up together, on the principle that anything is good enough for the intelligent mechanic. We do not believe that because a man may be able to put a few sentences together more or less grammatically, and to get them printed, he is thereby constituted the artizan's superior to the extent of being warranted in writing down to the assumed level of the mechanic's intellect. The workman's intelligence, though probably limited to a few channels, is by no means feeble in direct proportion to its narrowness; yet, to glance over some specially designed appeals to his attention, it would appear that he is considered by some writers to lack the commonest elements of knowledge, even in his own restricted walk in life. To these attempts to put workmen into leading-strings is to be ascribed much of the failure that has attended the practical application of the once-popular mutual improvement idea. The present little manual is certainly better provided than usual with sound information for workers. Mr. Lloyd Wise contributes an article on the Patent Laws, full of advice to inventors, by attention to which they may save much expenditure of time and money in the mazes of the law. There is a simple string of instructions in the use of gas in dwelling-houses, and there are other contributions of equal utility. On the whole, we are disposed to recommend this almanac as being a good example of its class.

* See JOURNAL, Feb. 10, 1880; Vol. XXXV., p. 208.

† Manchester: J. Calvert. London: Simpkin, Marshall, and Co.

A NEW PHOTOMETER.*

In this pamphlet the author, who is described as Chief Engineer to the gas engineering firm of F. Schweickhart and Co., of Vienna, propounds a theory on the scientific measurement of light by means of a photometric apparatus of his own invention. The method in question is claimed to be free from the defects of the Bunsen and all other photometers yet produced. The author promises to publish shortly an exhaustive treatise on photometry, wherein we may presume the existing methods will be extensively scarified, and his own proposals as forcibly advocated; but, for the present, the publication before us is not lacking in either respect. Herr Coglievina devotes the first part of his book to proving the preamble with which he starts—that the Bunsen photometer, in its selection of a standard, in its screen or disc arrangement, and in its scale, is unscientific, unreliable, difficult to manage with accuracy, and generally unsatisfactory. With the general gist of his indictment of the normal candle most of our readers will be already familiar, as he merely repeats the complaints of others who have endeavoured to supplant it with fresh devices. None of the well-known standards advocated by Messrs. Methven and Vernon Harcourt, or the various kinds of lamp standards suggested or in use, meet with his approval, the first-named apparently offending him very deeply, not only on account of its alleged inefficiency, but also because its authorship is claimed by an Englishman, whereas, according to him, it was suggested by Dr. Rüdorff long before Mr. Methven took it up. Dr. Rüdorff has abandoned it, and Herr Coglievina appears to think it time Mr. Methven and his friends followed suit.

We need not follow our author in his disquisitions upon the ordinary screen and scale, but will proceed to state as briefly as possible the requirements of a perfect photometer on his system as laid down in the second part of the pamphlet. These are six in number, as follows—(*a.*) the beams of light must be made to take a certain direction; (*b.*) the light must be at a certain height; (*c.*) the image of the light must be capable of reliable observation; (*d.*) the scale should be plain; (*e.*) a new reliable unit of light must be determined; (*f.*) a name in unison with the present state of science must be conferred on this unit. It will be observed that, in this list of *desiderata*, certain things in universal demand are mixed up with requirements only intelligible in view of the author's own apparatus. We will take the proposed new unit first, as being really the point of departure, subsequently dealing with its application. Herr Coglievina lays down the incontrovertible axiom that all beams of light, from whatever source derived, have a certain determinable point at which they cease to illuminate objects. As he puts it, a source of light is the centre of a lighted sphere of finite radius, the relative illumination of any points within the sphere being inversely proportionate to the square of their distances from the light-centre. Consequently, if we select any of the rays, for convenience sake rendering them parallel and of a definite size by a suitable lens, and adopt some means of finding the length to which these rays are visibly projected, we shall obtain a fixed datum by which to value any other rays sent from the same light-centre in another direction, and by the same means we shall have a fixed term of value for the light itself. For example, if a feeble light, such as that from a lamp or a small gas-jet, be displayed in a dark room, dark objects in the distant parts of the room would be invisible unless brought to within a certain distance from the lamp. This distance, then, is the length of the longest beams of the light given by the lamp, and is the normal coefficient of the light, by reference to which light beams from any other source are measurable.

If a photometer were to be constructed simply on this principle, it is evident that it could be used only for very feeble lights, or its dimensions would be outrageous. The principle is, however, susceptible of modification to the extent required to bring it within the range of apparatus of the ordinary size. By focussing the light in a double convex lens, so as to get a bundle of parallel rays of definite diameter, and then reflecting these rays through a series of silvered reflecting prisms, the length of the rays may be greatly diminished, and their termination brought more easily under observation. Now comes the question of how the end of the rays is to be detected. The author employs for this purpose a ball of phosphorus enclosed in a case, exposed to light only through an orifice just large enough to admit the rays projected through the prisms before mentioned. The phosphorus itself is kept in a perfectly dry air-tight glass tube. [It should be stated that the author does not confine himself to the use of phosphorus; any more suitable material, changing with the impact of light, would answer the purpose.] The phosphorescent ball is, of course, visible in the dark, but the phosphorescence ceases when it is touched by a beam of light. Hence if a beam projected, in the manner described, from a controllable source of light just reaches the phosphorus, the beam may be said to be of the *normal length*. If the beam is too strong, and extends beyond the phosphorus ball, which will be seen by the phosphorescence entirely ceasing, the light must be lowered until the exact effect is obtained. This light is the unit from which any other light can be measured. For, in the arrangement shown by the author, the rays from the right-hand side of the standard unit are focussed and mirrored to determine the normal length of ray, while the left-hand rays are similarly focussed into a parallel bundle, and directed by two reflecting prisms to an opaque ball, of equal diameter to the rays. The light to be measured by this standard is placed opposite to it, and a similar bundle of its rays is directed to the other side of the opaque ball. The author states that a ball thus illuminated from both sides, when observed by reflection in a plane mirror, is much more reliable than the screen or disc of the Bunsen photometer. The ball shows distinct light and dark hemispheres, with a sharp line of demarcation, when the two lights are very slighly unequal. He states that the observer's notice is in this case easily caught by the simple line dividing the two hemispheres, when he might not be able to appreciate the same difference between the two sides of a paper disc.

Herr Coglievina gives many diagrams in illustration of his argument, and also two plates showing his photometer in elevation, plan, and section. It will not be fair to the ingenious author to describe his apparatus more minutely, nor is it necessary in order to appreciate the *rationale* of his method. As we have seen, he depends entirely upon certain points which will assuredly be speedily put to the test. Recapitulating very briefly, we have seen that his standard, *a*, is a light of any kind—but preferably of the same nature as the light to be measured by it—of such intensity that its longest beams have a certain length, *ax*. This length is to be tested by a certain substance—for example, phosphorus—which being fixed at the point *x*, denotes to an observer, who watches its image in a mirror, when the rays from *a* just reach the point *x*. This being settled, the standard, which may be called by any definite name, becomes an entity as rational as a degree of the thermometric or barometric scale, and as universally applicable to all kinds of light as those scales are to the general measurement of heat and pressure. In fact, we shall have to discard the unscientific term "candle power," which is as vague as though we were to use the phrase "oven heat" for temperature, or any other similarly loose expression for the measurement of weight or volume; and speak of illuminating power in terms that will convey some idea of the distance to which the light-rays will penetrate. This is a solution doubtless to be desired, but it remains to be proved whether Herr Coglievina's standard is destined to lead us any nearer to it or not. The manner of determining the length *ax* is at least open to question. Again, there is much to be said respecting the author's selection of an opaque ball, instead of a disc, as a light-recipient.

With a single reference to the title of the instrument our notice must close. It is called a centigrade photometer for the following reason:—The normal light having been adjusted in the right-hand compartment, the light in the left-hand division is made exactly ten times as powerful by a ready method of adjustment. This multiple of the standard is now taken as the normal, and a light up to ten times greater intensity may be measured in the right-hand box where the normal standard was first exhibited. Thus, by advancing in a centigrade proportion, on each side alternately, a light of any power may be tested in the same apparatus.

The usual extra fittings, such as meter, clock, &c., are, of course, used in connection with the new photometer, when intended for measuring the illuminating power of gas.

* Centigrad-Photometer: Neues Optisches Instrument zur Directen Bestimmung der Intensität jeder Beliebigen Lichtquelle. Von Domenico Coglievina. Braunschweig; F. Vieweg und Sohn. 1880.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

DR. ADAMS'S GAS STOVE.

SIR,—A few days since I wrote you a letter, in reply to a communication from Mr. Bruce on this subject, and I have just now seen in the JOURNAL of the 7th inst. Dr. Adams's letter of the 27th ult., in which he charges me "at the head of three columns." I find it difficult to reply to Dr. Adams, as in November he gives a flat denial to the statements made in October by Mr. Wright, of Birmingham, the very witness he asks me to refer to as one "who is co-operating with him in a series of tests."

Dr. Adams charges me with "a *pure fabrication*" in saying that "the new stove, by Dr. Adams's own statement, 'gives 8 to 16 times as much useful effect as any stove hitherto made.'" "This alleged quotation," he repeats, "is a pure fabrication. I never made the statement and never held the belief it expresses."

So far Dr. Adams of November. Now hear his collaborator, Mr. Wright, in October:

"As a means of comparing the results obtained from this with those obtained from other stoves, we annex particulars of tests made by Dr. Adams and Mr. J. L. Bruce. No. 1 gas stove gave the best results of any ordinary gas stove that was tested, and is therefore fairly used for comparison with No. 2 (Dr. Adams's new stove)—

	Units of Heat Utilized per Cubic Foot of Gas.
No. 1 stove (giving the best result of any gas-stove hitherto made), burning 10½ cubic feet of gas per hour	3,658
Ditto, burning 13¾ cubic feet per hour	6,336
No. 2 stove (Dr. Adams's), burning 12½ cubic feet per hour	51,300

"These results are *certified*, and may be taken as correct, and a fair comparison between the two stoves."

If the English language means anything, surely this statement means that the results were certified by Dr. Adams and Mr. Bruce.

Now, if we compare the second test with the third, since 51,300 ÷ 6336 = 8·1, Dr. Adams's stove was over eight times more efficient than the best gas stove hitherto made; while if we compare test No. 1 with test No. 3, we find it (51,300 ÷ 3658 =) 14 times better than "the best," &c. Struck with the monstrous exaggeration of such a number, I wrote 16 instead of 14 times, looking probably at the thousands, and neglecting the smaller numbers. This, however, makes no practical difference in the effect of an exaggeration as gross as I ever met with. If there is any "*pure fabrication*" here, it surely is not mine.

Next Dr. Adams denies the accuracy of my figures of the weight and the specific heat of air. With respect to the first, he says that a pound of air at 62° Fahr. is equal not to 13·140 but to 13·156 cubic feet. The difference is of no importance whatever to the question; being one of far less than 1 per cent., and not much more than 1 per mille. But as my accuracy is impeached, I must again refer Dr. Adams to one of the authorities quoted by himself—namely, Mr. Kinnear Clarke's useful "Manual of Rules, Tables, &c."—where, at p. 351, he will find the

number of cubic feet in 1 lb. of air at 62° given as 13·141. I did not think it necessary to go to the third place of decimals.

The next charge of inaccuracy is certainly the most astonishing instance of hair-splitting I ever heard of. Mr. Bruce unites with Dr. Adams in making the grave charge against me that I put down the quantity of heat necessary to raise 1 lb. of air 1° Fahr. as 0·237 instead of 0·238 of that necessary to raise 1 lb. of water through the same interval. I made a mistake in the third place of decimals! Indeed, Dr. Adams refines upon Mr. Bruce, the latter saying 0·2380, the former 0·2379. I feel guilty; but practical men will, perhaps, condone the offence when they remember that with coal at even 18s. 8d. per ton one gets 10 lbs. of coal for 1d.; that each pound gives 14,000 thermal units; and that a difference of 1 in the third place of decimals means one-thousandth of an unit, or in money value the *one hundred and forty millionth part of a penny*. I am quite as ready to acknowledge such an error, as I am sure Regnault would have been unwilling to bind himself to that accuracy in the fourth place of decimals to which Dr. Adams seems to tie him down. It appears strange that any one who understood the nature of Regnault's beautiful processes should have imagined that such accuracy was attainable in so difficult an investigation. "*De minimis non curat lex;*" but the Doctor cares about minims which the law disregards.

Dr. Adams's calculation founded on his figures—viz., that 13·14 ÷ 0·238 = 50·5—is evidently a slip of the pen which may happen to any one. The quotient, of course, should be 55·21. My original statement being 55·5, there is a total difference of about ½ per cent. Thus the "*material*" difference becomes utterly immaterial.

For Dr. Adams's information about "burnt air," I should be grateful if it were either novel or admitted by better authorities. Through all his other statements I have no time to travel, but will give a specimen of one of his witnesses—Dr. Ure's "Dictionary of Chemistry"—a book, by the way, of no authority. It is from this quoted that 1 cubic foot of gas can warm an apartment of 2500 cubic feet contents from 60° to 80·8°, or 20·8° Fahr. Such an apartment would be about 16 feet square and 10 feet high. The room in which I am writing at present is of less capacity than this. I have been sitting in it for five hours with three lights burning, each consuming 4 cubic feet of gas. As Dr. Ure says that 1 cubic foot of gas heats such an apartment 20°, 60 cubic feet must have heated it 1200°. Strange to say the lead pipes have not melted, the brass fittings are not red-hot. The paper I write on is not burned to a cinder, my steel pen, I am happy to say, has not lost its temper, although it has been charged with *fabrications* pure or impure. I enjoy, I trust, the "*mens sana in corpore sano*," the latter being only comfortably warm and the former perfectly cool. As I am ambitious to be a martyr of science, I am willing to remain for an equal length of time in the same room with double the number of feet of gas burned in Dr. Adams's stoves, and a lady has offered to be cremated with me in order that posterity and Dr. Adams may inscribe on her martyr-tomb:

"Then the *toast*, then the *toast* shall be dear woman."

Neither my time nor the patience of your readers would allow me to follow Dr. Adams through all his devious windings—about coal, illuminating power, &c.—which have nothing whatever to do with the question in hand. I am acquainted with Dr. Wallace's experiments, which he himself gives as only rough approximations. In his deductions from these experiments I do not at all agree, for reasons which I will at some other opportunity point out, and which I think he will admit to be sound.

In conclusion, I may say that on the day following the appearance of my first letter I received from a gentleman with whom I have only a slight acquaintance, and who occupies a very high position as a scientific and practical investigator of similar questions, a letter thanking me warmly for my communication, and characterizing the statements about Dr. Adams's stoves in words which it would be unpolite to that inventor to repeat.

Cork, Dec. 9, 1880. DENNY LANE.

SIR,—Mr. Lane, in his letter referring to my stove, gave 13·156 as the weight of 1 lb. of air at 62° Fahr., and 0·237 as the specific heat of air, and dividing the former by the latter, he brought out 55·5 as a divisor for my units. In my commentary I gave 13·14 as the weight of the air, and 0·238 as the specific heat; and dividing the first by the last, I brought out 50·5, instead of 55·2. This error is caused by mistaking a badly-formed figure of 5 for a figure of 0—in short, a slip of the pen while hastily transcribing a copy from my rough jottings of memoranda. My letter was written while on the very eve of a journey from home. JAMES ADAMS, M.D.

[At our correspondent's desire, we forwarded a copy of this letter to Mr. Denny Lane, in anticipation of his commenting on the error pointed out; and it will be seen from his letter, printed above, that he notices the error merely as "a slip of the pen."—ED. J. G. L.]

PORTISHEAD DISTRICT WATER COMPANY.—The ordinary half-yearly meeting of this Company was held on the 30th ult.—Mr. F. Weatherly in the chair. The Directors report, which was presented, stated that, owing to the stagnation of trade in general, and the depressed condition of the industries of the district, there had not been any increase in the Company's business. The Directors anticipated, however, that the money now being expended on the docks and railway would lead to an improvement of the general condition of Portishead, and consequently to an extension of the Company's operations. The Chairman, in moving the adoption of the report, said that as the Directors had had, in the course of the past half year, to issue debentures to pay off the contractors, they were left with a balance in hand of only £88 11s. 9d. out of the revenue, and it would be for the consideration of the Shareholders whether or not a dividend should be declared out of this small amount. He then referred to the causes which had operated to retard the progress of the Company in the past half year, but assured the Shareholders that every attention was given to their affairs by the Directors, and with the appointment of a Manager, which was in contemplation, it was hoped that the value of the Company's property would be increased. Mr. C. Fisher seconded the motion, which was carried, and the proceedings closed with a vote of thanks to the Chairman.

Miscellaneous News.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held on Thursday last—Alderman H. E. KNIGHT in the chair.

The SECRETARY (Mr. A. Jelley) read the advertisement convening the meeting and the minutes of the last meeting, which were confirmed.

The report of the Directors, which was taken as read, contained the following remarks:—

In the past half year 2318 new supplies have been brought into charge, the estimated annual rental from which is £4036; and during the same period 11,091 yards, or upwards of 6 miles of new mains have been laid, of which 256 yards are not within the Company's parliamentary area; 3400 yards of existing mains have also been altered, relaid, or lowered, to improve the service of the district.

In consequence of the action of the Government respecting the Water Supply of the Metropolis, your Directors were under the necessity of withdrawing the Bill they had introduced into Parliament for the purpose of obtaining powers for the construction of additional works, &c. Notices have been given by Government for the introduction of a Bill into Parliament in the ensuing session to carry out the recommendations of the report of the Select Committee on the Metropolis Water Supply; such Bill will receive the earnest attention of your Directors, in order that the interests of the Shareholders may be duly protected. Your Directors have again, with regret, to call attention to the very heavy legal and other expenses which have been forced upon the Company in consequence of the proceedings in Parliament and otherwise, respecting the question of the Metropolis Water Supply.

Your Directors recommend that a half year's dividend at the rate of 7½ per cent. per annum on the ordinary stock and class "D" shares of the Company, and 5 per cent. per annum on the preference stock of the Company, be declared.

The CHAIRMAN, in moving the adoption of the report, said the Shareholders would find, on looking at the accounts, that the only addition to capital in the half year was £3076, £2590 of which had been expended on new mains and pipes. The revenue account to the 30th of September last showed that £918 had been expended on maintenance and repair of impounding and service reservoirs, filtering-beds, &c., and this amount compared with £266 last half year, and £219 in the corresponding period of 1879. They had spent this money in pursuance of their determination that the water supply should, as far as possible, be of the best description, and to do this they had incurred extra expense in cleaning the works oftener than usual. On maintenance and repair of mains £9800 had been expended, as against £12,000 last half year, and £9000 in the corresponding period. Pumping and engine charges, including the cost of coals, wages, &c., were this time £10,100, against £10,700 previously, and £10,300 in the corresponding six months of last year. The Directors had effected a saving in this item of £420 by the new coal contract. On filtration £1372 had been expended, against £900 and £1300 on the two previous occasions, and everything had been done to render the filtration perfect and effective. Rates and taxes, to which he should call attention later on, figured this time for £4600, against £3900 last time, and £4100 in the corresponding period of 1879, and the item was constantly increasing. The first item under the head of management to which he would call attention was commission to collectors, which had increased to £1960 from £1939 last half year, and £1800 in the corresponding period. This payment was a satisfactory one, as it demonstrated the Company's prosperity. The law and parliamentary expenses were £2780 in the last and £2763 in the previous half year—together nearly £6000—and he should show further on how this, he was going to say iniquitous expense, was forced upon their own and other Companies, and how it affected them. The expense of £2780 was made up of £1478 paid in prosecuting the Company's Bill in Parliament. This Bill was to enable them to erect works which would become necessary in the next eight or ten years, and no doubt, had they gone on with it, they would have obtained it, but they were obliged to abandon it in consequence of the action of the public authorities. He felt very strongly that under these circumstances it was not fair to saddle the Company with the whole of the expenses. They went into the negotiations with the late Mr. Smith for selling their undertaking, on the understanding that the expense of the negotiations would be borne by the purchasing authority. They had afterwards to defend their interests before Sir W. Harcourt's Committee, and the total expense there was £1024. He maintained that expenditure forced on them as this had been should be an addition to capital. Out of the remaining £278 for legal expenses a very large portion was spent in defending their interests from the attempt of the Lower Thames Valley Main Sewerage Board to place a large sewage farm in close proximity to the Company's works; and their legitimate legal charges for the half year were only £100 or £150. The dividend and interest account for the transfer of profits was £49,979—suppose they said £50,000—which would compare with £45,000 in the preceding half year, and £50,500 in the corresponding period. The amount was therefore £1500 less than in 1879, though the revenue was £5000 more; and in explanation of this he gave the details of extra charges in the past half year amounting in the whole to £5500, reduced to £4525 by less payments under other heads. On the other side of the account, the allowances for empty houses came to £2590, against £2300 and £1700 on the two preceding occasions. This showed a considerable increase, but it was to be remembered that the Company had many thousands more houses than they had a year ago, and the badness of the times had no doubt caused many houses to be empty. Overcharges figured for £1063, against £1700 last half year and £1300 in the corresponding period; and the bad debts were £1100, against £1500 and £1400. The better system of supervision which the Board had established was now working satisfactorily, as was shown by the decrease in the bad debts, which also proved that the collectors and inspectors were doing their duties better. Water-rents accrued to the date of the accounts were £92,637, against £88,900 last half year, and £87,600 in the corresponding period of 1879, and the increase must be looked upon as satisfactory in every respect. Water companies—this Company, at all events—were persistently maligned, and it was said that they raised their income by screwing up the rating to the utmost. He had before stated that this was not the practice of the Southwark and Vauxhall Company, though they had undoubtedly investigated the rating in their district, and had made rectifications where there were glaring anomalies; but during the past half year the increase of £5000 was nearly wholly obtained from new houses. In the six months to Michaelmas last the Company laid on 2318 new supplies, producing £4036 per annum, and in the corresponding half year they laid on 1940 new supplies, producing £3386. The only item in the dividend and interest account to which he would draw their attention, was the balance applicable to dividend, which was £37,700, against £42,000 last half year, and £45,000 in the corresponding six months; and in explanation of the decrease, notwithstanding the greater prosperity of the Company, he referred to the large amount of unappropriated profits they had been accustomed to carry forward for the equalization of dividends. Last half year they reduced the amount from £16,000 to £9000 to pay the dividend, and consequently they only had this £9000 to swell the balance from their profits, instead of the £16,000. He had called this amount "unappropriated profits," not "reserve-fund," because if the Company had a reserve-fund, and the undertaking were purchased, this fund would be required by the purchaser. Besides, they did not require a reserve-fund, as every half year they did all that was

necessary to maintain the efficiency of the undertaking throughout. After next half year this amount would again steadily increase, as their increased earnings would be *plus* the £4000 they had been paying half yearly out of revenue to Messrs. Harvey. This payment would then cease. In the balance-sheet, temporary loans stood at £25,000, against £29,000, but it had since all been paid excepting £5000, and he expected that the balance would be on the other side in a few days. The item of £3196 in suspense for expenditure on account of works had been increased by making experiments respecting other sources of supply. It was often supposed by people outside that water companies rested on their oars, and took not the slightest trouble as to what should be done to improve their supplies; but the companies did not take things so quietly. In the past twelve months they had been very actively at work in considering other sources of supply, and they had, he thought, made great progress, and were approaching something which he believed would be hailed with great satisfaction. This was all he knew of to call the Shareholders attention to respecting the accounts. Passing to the report, he went through and commented upon the various paragraphs. Clause 2 stated that in the past half year they had laid as much as 11,000 yards of new mains, which, in itself, demonstrated the elasticity of the undertaking. Of this 256 yards were laid outside the Company's parliamentary area, but this could not be helped. As he had explained on previous occasions, these mains outside the areas were paid for by the parties requiring them. It was further stated in the report that "3400 yards of existing mains have also been altered, relaid, or lowered," and this meant a great deal. It meant that the districts where the mains had been altered were able to have a much better and stronger supply of water; and that the water, if required on an emergency in any particular locality, could be more easily and rapidly concentrated. It also meant that those mains which were too near the surface and exposed to frost had been put in a position of safety. These matters were of the highest importance, and were paid for out of revenue. The Directors had not found it necessary in the past half year to act on the Shareholders resolution to raise further capital; and the exercise of this resolution would depend on the proceedings of Parliament; but the resolution would be acted upon whenever it was necessary. The report stated, as he had already mentioned, that the Company withdrew their Bill consequent on the action of the Government respecting the Water Supply of the Metropolis. He had stated the expenses incurred in the prosecution of the Bill, and clause 6 of the report referred to the very heavy legal and other expenses which had been forced upon them. Taking these items together, they amounted to £5543 in the year, which meant 1½ per cent. dividend on their ordinary stock for the half year, and but for these expenses the Company could have paid on the present occasion a dividend of 9 per cent. instead of one of 7½ per cent. He contended that the public ought to pay for these expenses; but what he had just stated proved that the water companies, who had served the public faithfully for so many years, and for years did not earn one penny in dividend, if let alone, and not forced to pay these shameful expenses, would soon reach their parliamentary limit as to dividend, and then be able to make very large reductions in the water-rates. The sooner the public understood this the better. The Bill which the Government had notified their intention of introducing into Parliament next session to carry out the recommendations of the report of the recent Select Committee on the Metropolis Water Supply was to create a Water Trust, and this would again necessitate the Water Companies going to Parliament. They did not object to the establishment of a Water Trust, or to their undertakings being purchased—they only wanted a fair price; and they would all strenuously act so as to ensure fair treatment. Nothing was more calculated to shake confidence in all joint-stock companies than the application of public money to depreciate these undertakings. He did not believe the House of Commons would tolerate such a thing. The Directors would carefully watch the Bill. The Board had considered the question of the Auditors remuneration, and recommended an increase in their fees from 20 to 30 guineas. The retiring Directors were Alderman Stone, Mr. Noel Whiting, and Alderman Finnis; and the retiring Auditor was Mr. C. J. B. Hertslet, and he counselled the Shareholders to re-elect these gentlemen. He had said that he should again refer to the question of the rating, and he reminded them that the old assessment of the Company in the various parishes was £30,526, the average rate on which had been 6s. in the pound in the past three years. This £30,526 was settled only five years ago, and it was proposed now to increase it, not to £35,000 (which might be regarded as a fair amount of increase), or to £40,000, or to £50,000, but it was actually proposed to be increased to £56,000 for the next five years! The Directors had settled with all the parishes excepting four for a total assessment of nearly £19,000, and the four parishes they were in dispute with claimed at first about £40,000, which they had so far had reduced to £31,900. The previous assessment in these four parishes was £17,000. The Directors, however, had contended that this £31,900 was perfectly ridiculous, and they wanted a very much larger reduction. Suppose nothing were taken off this £31,900, it would mean that the Company would altogether be assessed at £20,000 more, and 6s. in the pound on that amount represented £6000 per annum, or about 1 per cent. on their ordinary stock. But for the law expenses to which he had referred, the Shareholders would now be receiving 9 per cent. instead of 7½ per cent., and but for this increase in their assessment they could pay next year 10 per cent. The consequence would have been that, their limit being reached, they could have turned their attention to reducing the water-rates. The very figures, within a few pounds, which he placed before the late Mr. Smith, had been realized. He told Mr. Smith that the Company would pay 7½ per cent. up to June, and have a few thousands over; and they had paid 7½ per cent. up to Michaelmas, and had £5000 over. The increase which Mr. Smith accepted for the Company was £3500, whereas from new layings on in the last half year they would have over £4000. The public had yet to learn and to regret the bargain they had lost, and the Shareholders had yet to learn that his (the Chairman's) views of their undertaking were not too sanguine. As it was, the Directors could have paid 8½ per cent. dividend on the present occasion, and have carried over something, but they thought it better to carry over not less than £5100. During the last three or four years they had raised the dividend from 2 to 7½ per cent., had reduced the complaints to a minimum, and had expended between £40,000 and £50,000 in placing the works in a thorough state of efficiency, and in vastly improving the quality of the water. The Company had not increased their water-rates as far as the Act of Parliament enabled them, and finally their stock, which was selling at £100 when he joined them, was now worth £223.

Mr. C. M. Vialls seconded the motion, which was carried unanimously.

The Chairman next moved the declaration of the dividends recommended in the report.

Alderman Finnis seconded the resolution, and it was carried unanimously.

The retiring Directors and Auditor were then re-elected, and a resolution increasing the Auditors fees, as recommended by the Board, was passed.

Mr. Duck then moved a vote of thanks to the Chairman and Directors, and warmly thanked the Chairman for his full and lucid explanation of the Company's affairs.

Mr. J. Wall seconded the motion, which was carried unanimously.

The Chairman acknowledged the compliment, and the proceedings terminated.

THE PRICE OF GAS AT ROCHDALE.

The Rochdale Town Council met on Thursday, the 2nd inst.—the Mayor (Alderman Baron) in the chair—and in the course of their proceedings the minutes of the Gas Committee were presented. These, among other things, stated that the Committee had resolved "that the price of gas be reduced 3d. per 1000 feet both inside and outside the borough, as and from the 1st day of January, 1881." Notice had also been given by Alderman Tweedale that at the meeting of the Council he would propose, as an independent member, a resolution that a similar reduction be made.

Mr. Petrie, in moving the adoption of the minutes, said he had not anticipated having to introduce the subject of reducing the price of gas, inasmuch as Alderman Tweedale had given notice of a motion on the matter; but at the usual meeting of the Gas Committee on the previous evening the subject was introduced, and after having been thoroughly discussed, the recommendation to reduce the price was passed with only two dissentients. The Council rejected a similar proposal of the Committee some time ago, but the reduction now suggested represented considerably less than the amount which was added to the revenue account last year, and therefore, even if the reduction was made as proposed, the profits at the end of the current year would be as large as they were last year. This was altogether independent of any prophecy as to how far the future might be better than the past had been, for he deprecated anticipations and speculations as to what might possibly be the profits. For his own part, he wished the reduction had been 6d. instead of 3d. per 1000 feet, for in this case the correct policy was a downward policy. The profits last year were quite as large as—he himself thought larger than—they ought to be. He did not think the Committee paid off enough by way of depreciation, though he hoped this would be set right in next year's accounts; but if they paid off the interest on loans, and a fair amount for depreciation, then he thought they ought to be satisfied with a profit of 2 or 3 per cent., and he hoped before very long the Committee would ask the Council to go farther in the way of reduction than they now did. If he thought there was any chance of carrying the proposal, he should like to move that besides reducing the price, as recommended, the charge for lighting the street-lamps should be paid out of the gas-fund, and also that a 40th part of the debt, instead of a 75th, as at present, should be set aside each year by way of depreciation. After making all these deductions, they would still have at the end of this year a handsome surplus to hand over to lessen the rates of the town, even if the consumption of gas showed no increase over that of last year. In reply to questions that were addressed to him, he said that the reduction in price was equal to about £800 on the ensuing quarter, which was the last of the present municipal year, or equal to about £2600 per annum. The present invoice price of gas was 3s. 11d. per 1000 feet; but the smallest consumers who paid promptly had it for 3s. 9d., and the largest consumers for 3s. 6d. As to the percentage of profit there would be on the capital employed at the works, after deducting the proposed reduction of 3d. per 1000 feet, he might say that last year the surplus profits and the interest paid on loans represented 9¾ per cent. on the mortgage debt. If they made the reduction, the profits this year would still be larger than last, so that they would represent more than 10 per cent.; 4 per cent. of which was absorbed in paying the interest on loans, leaving 6 per cent. to go towards the rates.

Alderman Taylor said the amount of money which their Act of Parliament obliged them yearly to repay of their borrowed capital was only 1-75th, but he had a perfect recollection that in the time of the Commissioners, when the works were taken over, it was agreed that 2½ per cent., or 1-40th part, should be set aside annually. This resolution, he believed, had never been rescinded, but when the time for repayment was extended it was ignored, and ever since the Gas Committee had only been paying off 1-75th yearly, which confessedly was too small a sum. He was glad the Chairman of the Committee was in favour of a return to the old practice, and he commended him for his desire to make the lighting of the lamps a charge upon the gas-fund.

Alderman Simpson thought the town was too heavily handicapped in the shape of rates, owing to expenditure which was in great part unavoidable, to lightly forego any source of revenue; and seeing that they sold gas at a cheaper rate than consumers could themselves supply it for, it was a question whether the Council should dispense with what fell so equally and was so voluntarily paid as was the revenue derived from gas. He thought it would be better to take over the street-lamps, which would reduce the profits by £4000 or £5000 a year, and which would do much to allay the feeling, both inside and outside the borough, that the Corporation were not justified in making the extravagant profits which were shown in their yearly accounts. The charge for the lamps was one which might very properly be taken out of the gas profits, inasmuch as they constituted a convenience alike for those inside and those outside the borough who might have business in the town. He also thought that though the outside consumers might not be charged more than a commercial price, and could not supply themselves for less, still, rather than afford them any temptation to do so, he would reduce the price to them; but as for those within the borough, who if they did not pay the money for gas would have to pay it in the shape of rates, he did not consider they had any just reason to claim a reduction.

Mr. Johnson said that the way in which the gas profits were to be applied was regulated by Act of Parliament, and therefore they were wasting time in discussing theories as to whether this scheme was better than that. As to the justice of the thing, if the whole of the property in the borough was of the same description, and all rated upon the same assessment, and all occupiers alike burned gas in proportion to their assessments, there would be no injustice in making gas a means of indirect taxation; but they knew that, as a fact, none of these premisses was correct. From figures laid before the Gas Committee at their meeting on the previous evening it had been calculated that if a reduction in the price of gas did not take place, the profits at the end of the current year would be £12,000; which meant a reduction in the rates of 1s. in the pound. And how would it operate? In this way: The occupiers of warehouse property, who consumed a comparatively small amount of gas, would escape the rates by that amount; while the cottage consumers, who burnt a large amount of gas relatively to their assessments, would have to make it up. He was only sorry, therefore, that the proposition was not to reduce the price of gas 6d. instead of 3d. per 1000 feet. He considered that, as they were surrounded on all hands by local boards who could, if they chose to apply for it, obtain power to make their own gas, it would be folly for the Corporation to abuse the monopoly they at present possessed by charging such a high price as would drive the people outside the borough to seek a supply of their own. He believed in the Corporation setting aside a fair amount for depreciation, and also providing, by a reserve fund, for any possible contingency; but beyond this, the greater the profit the greater the injustice on different classes of ratepayers. Since the works became the property of the Corporation a sum of £113,887 had been handed over in

the shape of profits, and had it not been for the immense sums spent on the reconstruction of the works during the latter years of Alderman Simpson's chairmanship of the Gas Committee, he believed they would have had no difficulty in reducing the price of gas at Rochdale to the same level as that of Manchester or Leeds, and in still making very fair profits.

Mr. J. Cheetham said when the proposal to reduce the price of gas was last before the Council he opposed it, but now the profits were so greatly increased that he should support it. He hoped they would try to make the gas 3d. per 1000 feet better, as they had not proposed to reduce the price 6d.

Alderman Littlewood said, as to the inequality in the contributions to the gas profits, he remembered one year taking the different amounts raised from gas profits by four different classes of property, and found that a cottage and a mill contributed something like a proportionate amount, but the discrepancy between a shop and a warehouse was something enormous. The warehouse got off almost scot free, while the shop paid a large proportion. Therefore the Council had no right to raise from gas more than a fair amount of profit upon the capital employed in its manufacture, and what was made above this ought to go in reduction of price.

Mr. Bright thought 10 per cent. was a fair profit—more than fair—and believing they would have above this if they did not reduce the price, he was in favour of the proposition.

Alderman Tweedale, pointing out the inequality of raising rates by means of gas profits, instanced a warehouse rated at £100 per annum, and a shop rated at £50. If, he said, the rates were paid in proportion to value, so the shop would pay about one-half what the warehouse paid. If it paid rates through gas profits, it would pay four times more than the warehouse. Then a house rated at £10 ought only to pay in rates about 1d., to 11d. paid by the warehouse; but if the rates were paid through the gas profits, the occupier would pay ten times the amount. The profits from the gas supply for the last ten years had been something like £60,000, which, if turned over to the General Purposes Committee, after paying interest on borrowed capital, depreciation taken off, and everything, would have been equal to 5 per cent. on the money invested. Whenever they had been able to pay over 5 per cent. they had reduced the price of gas. Now they were in a position to pay considerably more than 5 per cent., and it was their duty to reduce the price more than was decided upon by the Gas Committee. If it was such an equitable way of paying rates through gas profits, as some members said, why did not they greatly increase the price of gas, and reduce the rating? He was the first to advocate the abolition of the charge for gas for the street-lamps, and as the contracts for ammoniacal liquor would expire next year, and as they could sell this product for £3000 or £4000 more than under the present contract, they might reduce the price of gas as well as reduce the charge to the street-lamps.

The Mayor said, as there had been an increased consumption of 5 million feet of gas between the 25th of March and the previous Saturday, as compared with the corresponding period of last year, he was glad the Council did not reduce the price when the question was last before them, because in that case the increased consumption would have been attributed to the reduction in price. He did not think if the price had been lowered the consumption would have been a single foot more, and he must claim the increased consumption as an argument in favour of keeping the price as at present, because it showed that when people wanted gas they burned it at the price they had to give for it. Nothing had been said about the price of coal, which was going up, and if trade improved, as it had done during the last 18 months, the revival must reach the Rochdale district, and no one could say what would have to be paid for coal. Therefore if they lowered the price of gas they were going to do what the late Lord Derby described as taking a "leap in the dark," and in this he should have the concurrence of Mr. Johnson.

Mr. Johnson: I beg your pardon, I do not endorse that. It is a leap in the light we shall take.

The Mayor said figuratively speaking it would be a leap in the dark to lower the price of gas in the face of a rising coal market. There was evidence of an improving trade, and therefore they ought to have cheap contracts for coal for two or three years before reducing the price of gas. Another point he would put was this. The large consumers now had gas at 3s. 6d. per 1000 feet; the receipts of the Gas Committee last year were £51,073; the profits handed over to the general purposes fund were £8886; the difference between the receipts and the profits declared was £42,187; the gas thus cost nearly 3s. 4¼d. per 1000 feet. If, therefore, the Council accepted the proposed reduction, he should be very much astonished. He maintained that many hundreds of the small consumers, whose meters had to be inspected and their consumption entered up eight times a year, were an actual loss to the town, and thus other ratepayers had to bear the burden this imposed. If the Council took 3d. per 1000 feet off these consumers, it would be put upon the shoulders of others, and landlords could not increase their rents to recoup themselves for the additional rating they would have to bear to make up for the lessened gas profits, while the cottagers did not pay any rates directly. As to the outside consumers, they would soon help themselves if they could do better, and there had been no complaints from the outside districts. Further, the Council ought to make large profits to provide against contingencies, for supposing the electric light became adopted generally, the plant at the gas-works would only be worth old iron, old stone, and old timber. As to the £12,000 estimated as profits for the present year, he should believe in it when he saw it. They had a distinct right to raise money through gas profits for public improvements, and for every 3d. per 1000 feet they took off the price of gas they had to put 3d. in the pound on rates, for 1d. per 1000 feet of gas meant £1000, and a rate of 1d. in the pound meant about the same. Therefore, if there was any force in the argument on the other side, why not sell gas at cost price at once, and if there was any accident at the gas-works, rate for it? He, as Chairman of the Finance Committee, would resist all attempts to reduce the town's income from any source whatever; because they could not afford to give up any source of income. They would eventually have to come back to a 2s. 6d. improvement-rate and a 10d. paving-rate, or he did not know where they were to get their money from. He proposed as an amendment—"That the minutes of the Gas Committee be confirmed, with the exception of that portion referring to the proposed reduction in the price of gas."

Mr. Whitworth seconded the amendment.

Mr. Heape said when the motion for a reduction was last before the Council he opposed it, but he should now support it; as, notwithstanding what had been said on the other side, he thought a good case had been made out by the Chairman of the Gas Committee. Not being a member of the Gas Committee, he had not been able to go minutely into the case of the small consumers; but the Mayor had put it strongly that they were a loss to the town, and it seemed to him a fair way of meeting the case would be to make a charge for inspection or hire of meters, though it might be an unpopular proposal.

Alderman Tweedale said he should like to know where the gas profits came from if they accepted the Mayor's calculations. The Mayor tried to make it appear they were selling gas at about the price of production; but he was forgetting the £5000 or £6000 value of the residual products.

The Mayor said he gave credit for £51,000, which included £5292 for ammoniacal liquor, coke, cottage rents, &c., and the declared profits were £8886.

Alderman Littlewood said that the £5292 ought not to be included, but deducted. As Mr. Petrie had said, they could reduce the price of gas and yet their profits next year would be larger. How could the Mayor's argument be right in the face of that?

Mr. Petrie wished to say a word or two on the point mentioned by Mr. Heape and others as to the cost of collecting from small consumers. There was no doubt that they were bad customers, and that the cost of collecting their accounts was a large proportion of what they paid for gas. The gas department paid for inspectors £490 per annum, which divided by 16,000 consumers gave 9d. for each as the cost of inspection. This, on a very small consumption, would be a large proportion of what was paid for gas; but it did not interfere with the present proposal. It was a thing that must be remedied in its own way. The Committee had had the question before them more than once, and he had no doubt they would yet have to return to a charge for inspection. He did not think the Mayor's argument about the price of coal should frighten them. They had contracts entered into for some time to come, and if coal did go up largely they might ultimately have to raise the price of gas. In his opening remarks he was careful not to anticipate any increased consumption, but to go upon the figures of last year. He hoped the amendment would be lost by a large majority.

Mr. Johnson said he had listened to the Mayor with very great pleasure, and thought what an old Tory they had as Mayor for once—ignoring those Free Trade principles that he and a great many others had prided themselves upon for years; and he (Mr. Johnson) became more confirmed when the Mayor began to quote the late Lord Derby. He would take a Radical standpoint, and quote from the Right Hon. John Bright, who deprecated—and in his opinion very properly—indirect taxation. It was, however, left for the Mayor of Rochdale to justify indirect taxation. Whether the Right Hon. John Bright's or the Mayor of Rochdale's theory was right the vote that morning would, he said, decide.

After some further remarks, the amendment was put, and lost by 22 votes to 7.

The Mayor then proposed another amendment, as follows, which was, he said, to assist the Finance Committee to get the money in:—"That the minutes of the Gas Committee now read be approved, except the words referring to the reduction in the price of gas; and that in lieu of the proposed reduction in price we allow 3d. per 1000 feet extra discount for prompt payment."

Mr. Taylor seconded this amendment.

Alderman Tweedale said there would not in most cases be a sufficiently large consumption of gas in the summer months to induce people to pay promptly.

Mr. Petrie said the amendment was not right in principle. If they had a sufficient discount to secure a proportionate charge between large and small consumers, it was quite sufficient. The present discount was enough to induce people to pay promptly, at least he judged so from the large numbers that crowded to the office two or three days before the time expired.

Alderman Simpson said he should have thought the opponents of the previous amendment would have accepted this with unanimity, and he hoped the Chairman of the Committee would accept it as an amicable settlement.

Mr. Petrie said if the minutes were adopted he would promise to bring the whole subject of discounts before the Committee.

Mr. Bright thought such a proposal ought first to be ventilated in committee, and

Ultimately the amendment was lost, 10 voting for it and a considerable majority against it.

Mr. Petrie then, replying upon the original motion, said he wished to speak upon a point raised by Alderman Littlewood and others, who understood it had been stated that, if this reduction of 3d. per 1000 feet in the price of gas were made, next year's profit would not be equal to a 5 per cent. surplus, because they would not have allowed a sufficient amount for depreciation. This was not so. Those gentlemen who made the statement forgot that though the Committee had not taken off an extra amount for depreciation for the last two or three years, they had practically been going in that direction. They had two sums now amounting to between £2500 and £3000 which had been put to revenue account, but which under the old system would have been put to capital account. So it was practically an additional depreciation.

The minutes approving the reduction in price were then adopted.

AMERICAN GASLIGHT ASSOCIATION.

[From the "Official Report" in the *American Gaslight Journal*.]

(*Continued from p.* 859.)

Following the discussion of Mr. Forstall's paper on "Stoppages in Ascension-Pipes," General Hickenlooper read his paper descriptive of "Ross's Steam Stoker," an illustrated account of which appeared in the Journal the week before last, on pp. 855-6.

The President having invited remarks on the subject of the paper,

Mr. Forstall said he had studied the question of steam stoking, and so had the Manager of his works, with the result that four of Ross's machines had been ordered by them.

Mr. Helme said the first time he saw the machine he was impressed very favourably by it. He thought, however, with it, as with every other new machine, some little improvement could be suggested. The only real difficulty he saw in it was that it cost a trifle too much to allow of small companies using it. He thought General Hickenlooper spoke about six benches. This would be about 30 retorts. He did not doubt that the machine could be used with advantage in that case, because one or two of the men the General spoke of could probably be dispensed with, for the reason that it would not be necessary to charge so rapidly as with a large number of retorts. There were, however, a number of companies working less than 30 retorts, and these might find the machine expensive.

Major Dresser said with reference to the time employed in the use of these machines, he was in Cincinnati last spring investigating the subject. He went into the retort-house at odd times, and saw on several occasions 18 retorts drawn and charged in 16 minutes. This seemed to be about the rate at which they were generally working, and they only had two men on the machines, and the men opening and shutting the lids, as referred to in the paper.

The President: Did that include the time taken to fill the hoppers?

Major Dresser said it did, because the time occupied by the drawing machine was longer than that occupied by the charging machine. The charging machine could work faster than the discharging machine; consequently the men utilized the time they were waiting for the retorts to be drawn by filling the hoppers and getting ready to go on. The whole thing was regulated by the rapidity with which the retorts could be drawn. When the drawing machine was timed, the whole operation was timed. It was a question for large works whether there could not be some arrangement made by which it would not be necessary to use one charging

machine with each drawing machine—whether one charging machine could not charge the retorts for two drawing machines, if this arrangement could be made to work satisfactorily. The time for charging a retort averaged six seconds, as General Hickenlooper had stated. The time for drawing varied somewhat, according to the character of the charge. There was another thing that struck him very particularly in regard to the matter, and this was the uniformity with which the coal was distributed on the bottoms of the retorts by the charging machine. There was no piling up of the coal; it was laid with great evenness and exactness. The first lot of coal was sent to the rear of the retort, the next just in front of it, and the next just in front of that. When the lids were opened to discharge the coke, one could see exactly the condition in which the coal was left by the charging machine. On looking into 18 or 20 retorts no variation would be seen. The whole thing was done without any trouble. He was told that one of the men who was operating one of these machines had never previously been on the machine; and was not a man of more than ordinary intelligence. He thought this was a field wherein very many gas companies might save a vast amount of money, and also an immense amount of wear and tear upon the human system which attended the work now done by stokers. The men were removed so far from the fire that it was not disagreeable work to run the machines.

The PRESIDENT: And their use, in a great degree, creates independence of strikes.

Major DRESSER: Of course. If you do not use the machine—if you simply have it in the corner of the retort-house, ready for use in the time of a strike, it will be worth its cost. Where there are large gangs of men to be dealt with this is an important item.

Mr. PAGE said ten years ago he was in Dublin shortly after the Somerville stoker was put in operation at the gas-works there. Although it was a heavy and cumbersome machine, it was a great step in the direction of substituting machinery for the manual labour of stoking. He had seen the Ross stoker in operation twice at Cincinnati, and he could testify to what Major Dresser had said in reference to the time occupied in putting the coal in, and to what had been stated by General Hickenlooper on the subject in his paper. He was sure they all must agree, from the facts that had been presented to them, that mechanical stoking was one of the greatest advances yet made on behalf of gas interests. Unquestionably, by-and-by there would be a change in the mode of removing coke from the retorts. Instead of doing it mechanically with the rake, he believed that some inventive genius would put steam in behind, and drive the coke out.

Mr. BURTIS said he had seen the Foulis machine in operation in Glasgow and also in Manchester, and though the time occupied by it in charging and discharging the retorts was very small, he believed, from the statements that had been made to the meeting, that the Ross machine would do the work more quickly. The point referred to by the President, as to being independent of strikes, was one of the very things gas managers should look to in mechanical appliances, not only in the Ross stoker, but in any other machine that would do the work as they wished it done. They knew from experience that men were very apt to take advantage of managers being in a dilemma, and demand that which was unreasonable, and if they had a machine to charge and discharge the retorts, then, when peace had been made with the three or four men who managed them, they could put in ordinary men to break the coal and prepare it.

Major DRESSER said there was another point in regard to the character of the labour employed on these machines. It was of an entirely different character to the ordinary stoking labour. It was more of the character of men who attended to stationary engines—men who could be easily replaced, particularly in the small numbers that were required. In considering the matter of strikes this was an important item. It was easy to replace these men, while it might be difficult to replace men who were sufficiently skilled to act as stokers, and where, in stoking by hand, a much larger number would be required.

The Association then adjourned until the following day (Thursday, Oct. 14). On re-assembling,

General HICKENLOOPER said he wished to add to what he had said the previous day that at first he thought the application of the principle of charging, as described—viz., the blowing in of the coal—would produce a prejudicial effect upon the retort. In order to demonstrate to him clearly that such would not be the case, Mr. Ross first constructed a wooden retort, and cut it in two in the centre, longitudinally, placing the upper half upon the lower, and then he projected the coal, by the blast, into the wooden retort. After having done so, he raised the upper portion, and the concussion due to the blast was not sufficient to throw the upper half of the wooden retort off the lower half. After having thrown the coal in, he then raised the upper half off the lower half, and exhibited the coal laid in as evenly in the lower half as it could be put in by hand, or in any other manner. He (General Hickenlooper) was satisfied that he was correct, and endorsed his theory; and then the first experimental machine was taken down to the works, where there was an old bench that had been abandoned. It was going to pieces, and in some places was so loose the pieces could be taken out with the hand. He charged this bench with coal, and the concussion was not sufficient to dislodge any one of the pieces in the retort. This was proof positive that there was no concussion that would in any manner injure the retorts.

The PRESIDENT asked, if there was any prejudicial effect upon the benches. What had been the experience in this direction?

General HICKENLOOPER said their experience had been very satisfactory. It had produced no unfavourable effect upon the benches. If there were any incidental effects, one of them was that it had decreased the formation of carbon. He had no occasion, in the retorts that had been used with the machine, to put in carbon-pipes.

The PRESIDENT said he should like to know something more about the raking machine for drawing the charge of coke—whether it could be used when the retort was partially covered with carbon, or when it was irregular or had been shortened. It was sometimes the case that retorts became smaller than they originally were. He should like to know if the raking machine could be used advantageously under these circumstances.

General HICKENLOOPER said certainly. There was no combination of circumstances of that kind which could not be overcome by the use of the machine. It could be put in, for example, if the carbon should be formed to any extent in the roof of the retort. The governing power was such that the rod could be elevated or depressed to any position in the retort. It could be put in six inches or two feet, or its entire length and drawn out. The operator held the lever which thrust the rake bar in and out in one hand, and the lever that elevated and depressed it in the other. It was all done by a movement of the hand at the end of the rake.

The PRESIDENT: I suppose it is understood that all the movements are made, by men standing on the platform, by the use of the levers?

General HICKENLOOPER said that on the charging machine the operator stood on the platform, but on the discharging machine he stood alongside the machine on the retort-house floor. In answer to further questions, he said that his retorts were 16 in. by 22 in. ovals; he also had some D-shaped retorts, slightly rounded at the corners, for which they used a D-shaped hoe on the end of the rod. As to the effect upon the standpipes of the steam being blown in in the way described, he thought it had a tendency to prevent stoppages. They had had no trouble from this source since they commenced using the machine. So far as he had been able to determine, there was not any pulsation produced in the hydraulic main from the pressure of the steam—at least nothing perceptible on the gauge.

The PRESIDENT: Would there be any difficulty in using the machine in a retort-house without a basement?

General HICKENLOOPER said none at all. The only difficulty would be that there would have to be an increased width or space between the bench and the side wall of the retort-house. This additional room would be necessary for the space occupied by the car in which the coke was thrown. The only change in the machine that would be needed would be the lengthening of the rake and hoe, the machine having to stand at an additional distance from the face of the retort. The Manhattan Company of New York City proposed to operate it in this way, and allow room for a coke barrow between the bench and the machine. He might say that with them the coal was never touched by hand or shovel from the time it was loaded on the waggon in the yard until the coke was delivered to the consumer, probably miles away. They had a little trackway running into the yard, and a platform car. The bucket forming the body of the car was placed upon this platform, run to the portion of the yard from which the coal was being used, passed over a trackway to the crane, was elevated to the trackway above, placed upon scales and weighed, and then run in on a 2-foot gauge trackway to the bins situated alongside of the retort-house. The coal ran by gravity from the bins to the machine, was blown from the machine into the retorts, drawn from the retorts by the discharger, fell into a car situated in the cellar below, which ran on a trackway to the coke elevator, and was dumped into the coke-bins. The coke then ran by gravity into the waggons of the consumer or dealer, and was carried away. That portion of coke intended for use in the retort-house was deposited in a separate bin, ran by gravity on a buggy on a level with the retort-house floor, and was carried to the bench when required for use.

Major DRESSER: At the same time do you screen your coke?

General HICKENLOOPER: We have a double arrangement for screening, so that we get fine coke or breeze, which we use in our boilers about the works; the nut coke, which goes to the ordinary consumer; and the large coke, which goes to the manufacturer.

Major DRESSER: How many hydraulic elevators do you use?

General HICKENLOOPER: We have two for elevating coal, and one for elevating coke.

(To be continued.)

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

(*Continued from p.* 893.)

Mr. JOHN CHADWICK (Oldham) read the first paper, on

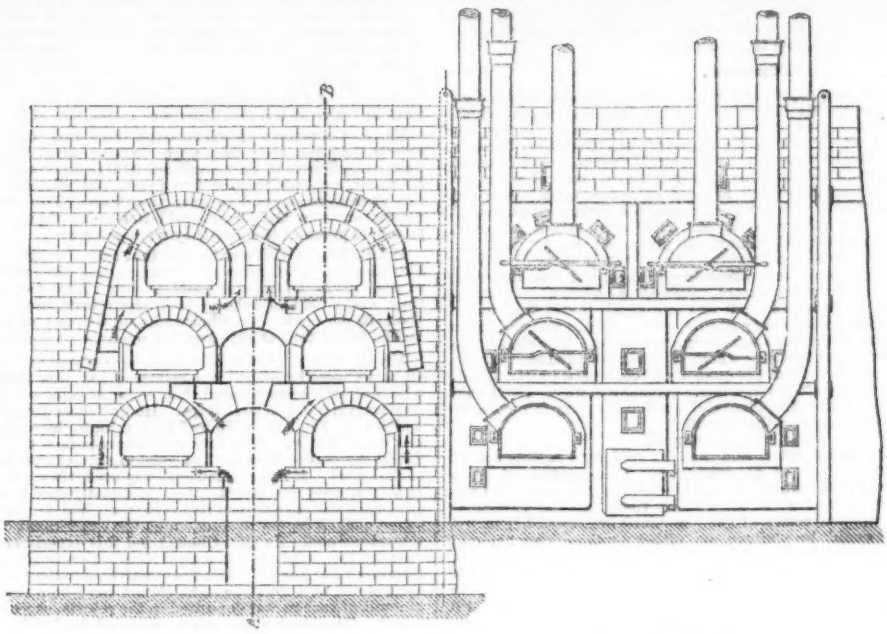
GAS-RETORTS.

In introducing to your notice the subject of retorts, I do not presume to be able to say anything that will be very new or novel in relation to the matter; but when I was asked to prepare a paper for this meeting, the thought struck me that we might perhaps with some advantage consider one or two modes of setting retorts, and compare amongst ourselves the different forms we use—viz., whether clay or brick retorts—and the results we obtain therefrom, and so, from our own experiences, which must be varied, we might possibly obtain some data, the study of which hereafter may be of benefit to us. I do not forget the excellent paper which was read here twelve months ago by our friend Mr. Webber—a paper which contained many excellent truths, and which will bear careful perusal again and again, and with profit too. I do not purpose going over the same ground which our friend did—viz., the "Economy of Heat in Retort-Settings," and the advisability of adopting regenerator furnaces, because it would be presumptuous in me to do so, but will rather confine myself to some comparison between clay and brick retorts, as to cost and durability. Whether it be true or not that "profits are made in the retort-house," or that the production of a large quantity of gas from a given weight of material is a *sine qua non* of good management, we need not now inquire; but I think there can be no doubt that we should have our retorts of such material and construction, and so adapted to our requirements, as to enable us to manufacture our gas in a sound, scientific, and economical manner, whether they be clay or brick.

Retorts are invariably made of cast iron or of fire-clay. Cast-iron retorts are seldom used, except in very small works, or in combination with clay retorts in works of larger magnitude. They are not capable of being worked at the high heats to which clay retorts are subjected, and have therefore been almost entirely superseded by fire-clay and brick retorts. Clay retorts are very extensively employed, and I believe are very much in favour, as good working results can be obtained by their use. They are manufactured from fire-clay, and have attained a high degree of excellence. Until a comparatively recent date they were moulded almost entirely by hand labour, and it was thought that a good and serviceable retort could be obtained only by this process; but recently machinery has very much come into use for retort-making, and I believe a much greater degree of perfection can be obtained by its use than by hand labour. Clay retorts are moulded to the desired shape and of convenient lengths, varying from 6 to 9 feet or thereabouts. Brick retorts are built up with bricks, tiles, lumps, &c., which also are made from fire-clay, and moulded to certain specified shapes and sizes, according to the form of retorts desired to be built. Brick retorts are, in point of fact, fire-clay retorts built in sections.

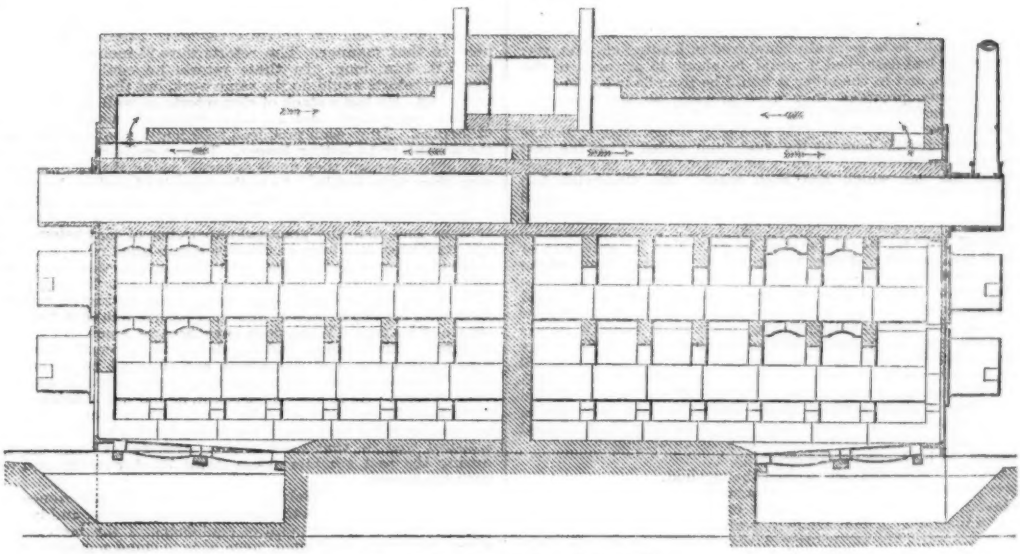
There are, as you are well aware, several forms and shapes of retorts, such, for instance, as the D-shape, the circular, the oval, &c., and each of these forms has its advocates. The object to be attained being the spreading of the coal as evenly as possible in the retort, I consider a flat-bottomed retort is best, and therefore prefer the D-shape.

The manner of setting retorts, whether they be clay or brick, varies very much both in the number of retorts to each furnace and in the conduction of the heat. We find all numbers of retorts, from one to about ten, set over one furnace, but the prevailing number seems to be from five to seven. Sometimes we find the arrangement of the draught to be an ascending one, at others a combination of ascending and descending. It is perhaps impossible to say which is the best method of setting retorts—probably all have their advantages as they have their supporters; but certainly we should endeavour to obtain a setting which, whilst giving the desired heat suitable for carbonization, will also be economical in the consumption of fuel. Here we may obtain some interesting information by comparing our settings of retorts and the consumption of fuel in them, together with the quantity of material carbonized, for I am certain that some settings will carbonize a given quantity of material with a less expenditure of fuel than others. Either because a better arrangement of retorts may have been chosen, or the furnace may be better adapted for its work, or from some other cause, better results will be obtained by some persons than by others. I have myself always used brick retorts, and therefore I have no practical experience with the working of clay retorts; consequently my remarks on the latter will be somewhat theoretical and from estimation.



Cross Section. Front Elevation.

Scale ¼ inch to the foot.



Longitudinal Section on Line A. B.

One of the settings I use, and which has been in use, with some slight modifications, for a long time, consists of two D-shaped retorts, 21 in. by 15 in., and one larger retort 6 ft. by 20 in. This setting carbonizes 7 cwt. of coal in four hours, or 42 cwt. in 24 hours; and taking the quantity usually reckoned of 10,000 cubic feet per ton, the make of gas is equal to 21,000 cubic feet in 24 hours. Assuming the large retort to be equal to two of the smaller ones, it would give 5250 cubic feet per mouthpiece in 24 hours. I consider such a setting of brick retorts to be equal in capacity to a setting of four clay retorts, and I will now compare a setting of each class as to cost and capabilities.

A setting of brick retorts of this class will cost, from the foundations to the hydraulic main complete, about £100, and will last for some 16 years. During the spring of the present year I took out some which had worked for 18 seasons. The cost of repairs will be about £6 annually; therefore these retorts would cost, say, £196 during their lifetime. They would work some seven or eight months, each season, and would in that time make about 4,725,000 cubic feet, or about 80 million cubic feet of gas in their lifetime, which is approximately equal to 0·6d. per 1000 cubic feet as the cost of retorts. A set of four clay retorts equal to these in capacity would cost about £80 when new, and the repairs would cost about £26 every two years, on the supposition that the retorts would last two seasons, and to repair them after one season's working and to replace them every second year. This would give us £288 as the cost of clay retorts for the same time as the lifetime of brick retorts, and taking 80 million cubic feet of gas as in the former case, we arrive at 0·86d. as the cost of retorts per 1000 feet, which is 43 per cent. more than the cost of brick retorts.

The quantity of coke used in these brick retort furnaces is about equal to 6 cwt. per ton of material carbonized. This, to my mind, is rather a large quantity, and I am endeavouring to reduce it somewhat, and have no doubt that I shall succeed. We have used two lengths of fire-bars, each 2 ft. 6 in. long and four bars in width. I have reduced the length of bars to 4 feet, and find a less consumption of fuel, while the retorts seem all the better for it. Possibly the consumption of fuel in clay retorts may be somewhat less than in brick ones, but of this I have no definite information.

The accompanying engravings represent another arrangement of brick retorts which I have adopted to some extent at Oldham, and which I purpose using more extensively as occasion serves. The retorts are built up of fire-bricks, tiles, &c., as represented. I may, perhaps, just explain the mode of conduction of the heat from the furnace to the retorts. There are six retorts, each 21 in. by 15. in. and 10 feet long, set in three separate heights of two on each height, the furnace being in the centre at the bottom. A portion of the heat from the furnace passes underneath the bottom retorts, and finds its way into the side flues; while another portion of the heat passes over the top of the bottom retorts, and underneath the middle retorts, and finds its way also into the side flues. From these flues the heat disseminates itself partly over the top of the middle retorts and underneath the bottom of the top retorts, and partly up the outside of those retorts. The heat is then conducted by means of longitudinal flues backwards and forwards along the top retorts until it arrives in the centre flue at the top, whence it is conducted to the flue in connection with the chimney. I have tried a combination of ascending and descending draughts in connection with this setting, but not with the same success as with the arrangements which I have just attempted to describe.

A setting of these retorts will carbonize 12 cwt. of coal in four hours, or 72 cwt. in 24 hours, and taking 10,000 cubic feet per ton (as before), they will make 36,000 cubic feet of gas in 24 hours, or about 130 million cubic feet per lifetime. These retorts cost about £130 per set, and assuming that they cost on an average £9 per year for repairs—though I think it will, if anything, be rather under this—they would cost, say, £274 for their lifetime. Therefore 130 million cubic feet of gas being the quantity made would give us 0·506d. per 1000 cubic feet as the cost of retorts. The quantity of fuel burned in 24 hours at one of these furnaces is 20 cwt., or equal to about 5½ cwt. of coke per ton of material carbonized. This I am endeavouring to reduce, but with what success I cannot yet say.

A set of six clay retorts would probably cost about £100, and two years cost of repairs would be about £35, assuming, as I did before, that new retorts would be required every second year. Then taking 130 million cubic feet, the make of gas as in the former case, the cost per 1000 cubic feet for retorts will be 0·7d.

I feel very diffident in expressing an opinion as to whether clay or brick retorts are best; I would prefer that you should draw your own conclusions on this point. I have simply tried to institute a comparison between the two; the information as to brick retorts being from my own practical experience, that relating to clay being as near as I could estimate from information I was able to obtain. If I am not strictly correct in my

figures under this head, perhaps some of my friends who use clay retorts will set me right. Although brick retorts may not be so extensively used as clays, still I consider they are good, sound, and serviceable articles, and will continue to be used for a long time to come.

Discussion.

Mr. J. PATERSON (Warrington) said he could only express his satisfaction and convey his thanks to Mr. Chadwick for his excellent paper, which brought before them a matter of very material importance. It was not by any means settled which was the best form of retort, whether brick or clay. He had not had any experience with brick retorts, and his belief had hitherto been that in the building of them they were met with one great disadvantage in the increasing number of points upon which the carbon would deposit itself. This was, perhaps, the strongest argument that he could use against brick retorts. Mr. Chadwick did not, however, refer to the matter, and he (Mr. Paterson) presumed he did not feel oppressed with these deposits of carbon. As to the process of setting retorts, that was again one of very great importance, and one in which he dared say they all, to some extent, differed in opinion. Probably the process adopted by Mr. Chadwick was one which would find many imitators. He thought it was a very good system. There was no doubt that the construction of the flues was an improvement. The object was to obtain to the utmost extent the whole of the heat produced by the combustion of the coke, and from the quantity of coke used by Mr. Chadwick he seemed to heat his retorts in a fairly economical way. He should suppose that the coal used by Mr. Chadwick produced a very fair coke, or he could not hope to use any less than he did.

Mr. CHADWICK: We use Wigan coal and cannel.

Mr. T. NEWBIGGING (Manchester) said that the subject of retorts was of the greatest interest to them as gas managers. The question of brick *versus* clay retorts was one to which he had given some attention, and the conclusion to which he had arrived was that there was no particular advantage, so far as the production of gas was concerned, on either side—that no superiority could be claimed for either brick or clay retorts; and the opinions expressed by the author of the paper confirmed him in this view. In speaking of brick retorts he wished to be understood as referring to brick retorts of the ordinary size, say from 18 to 24 inches in width. He did not refer to the large brick ovens 30 to 50 inches wide, and even wider, which were sometimes employed, and to which he had a strong objection. It appeared to him that the only points to be determined in making a comparison between brick and clay retorts were as to their relative durability, the cost of their renewal and maintenance, and the full expenditure in heating. These points had been very fairly brought out by Mr. Chadwick in his excellent paper, and certainly he had made out a good case in favour of brick retorts. The fuel account was in excess of what was, or what ought to be generally employed in heating clay retorts; in the one setting he had described it would be about 45 per cent. of the quantity of coke made, and in the other it would be from 35 to 40 per cent. In working clay retorts, provided they were properly set, the consumption of coke came considerably below the lowest of these figures, and it would have been proper, in estimating the cost of the brick retorts, to have taken the difference in the cost of the fuel, and added it to the cost of the setting and maintenance. This would have been a much fairer comparison than the one which had been made. Mr. Chadwick had explained that he could not make this comparison from his own practical experience, and therefore it had been omitted. There could be no doubt that the periodical and frequent renewal of clay retorts was an intolerable nuisance, which all of them would be glad to get rid of in some way or another, and if the quantity of fuel employed in heating brick retorts could be reduced to a reasonable percentage, he was strongly disposed to believe that these retorts would generally come into use, and that it would be desirable they should do so. There was less objection to them now than there was at one time. Formerly they were made about 4 inches or 4½ inches thick, and the quantity of fuel required to heat them was excessive. He wished Mr. Chadwick had entered a little more into detail as to the thicknesses of his bricks and tiles. He believed that brick retorts could now be made as thin as clay retorts, and this being so he did not see why, with a good setting, there should be any difficulty in reducing the fuel account. He should also have been very much pleased if Mr. Chadwick had explained how he attached his mouthpieces.

The PRESIDENT: It is shown on the drawing.

Mr. NEWBIGGING: But he did not explain the method.

Mr. H. VEEVERS (Dukinfield) said he was a strong advocate for clay retorts over either tiles or bricks. The reason of this was that he served his time under a man who made careful experiments on the subject, and demonstrated to his mind the superiority of clay ones. During the time he used clay retorts in his experiments he had a stack of tile retorts by the side, and after a trial of both for twelve or thirteen years, during which a careful account was kept, he came to the conclusion that clay retorts were the best. The retorts which he used were 9 feet long, a pretty good width—19 by 16 inches—and in one piece. Mr. Chadwick had very properly drawn attention to the lessened cost of brick ovens, owing to their endurance. He mentioned a case in which this form of retorts had lasted 18 years, but he (Mr. Veevers) would remind Mr. Chadwick that it did not follow, because an apparatus lasted a long time, that it was therefore the most economical. If they could get good gas in a shorter time from retorts which had not so long a lease of life, it might be very much better and cheaper in the end than to have retorts which had the one merit of lasting a very long time. There was one idea which had struck him, and which might perhaps be carried into effect, and this was the advisability of keeping the tops of the retorts cool. At present the coal was spread over the bottom of the retort; the top got hotter than it should be, and the hydrocarbon gases passing over the heated coal, and coming in contact with the top, became decomposed. This was, he believed, the cause of the large deposits of carbon. It would be very interesting if experiments were tried and the effect carefully noted of keeping the tops of the retorts cool.

Mr. H. WOODALL (Leeds) said that he used brick ovens many years ago. Why he abandoned them he did not know, but it was rather, he thought, from what other people said than from his own impression. His results were extremely good, and were better than those obtained from similar coal at neighbouring works. The life of the retorts was remarkable—11, 12, or 13 years—and Mr. Paterson, of Cheltenham, had told him that there were in use at his works ovens that were set 25 years ago. Mr. Livesey, some years ago, set up in one of his houses clay retorts. He (Mr. Woodall) told him he would regret it, and when he paid him a visit twelve months afterwards he found that the clay retorts were being pulled out, and Mr. Livesey said he was going back to the use of brick ovens. He (Mr. Woodall) considered that Mr. Chadwick had overrated the cost of his retorts in putting them down at 0·6d. His experience was that they only cost 0·5d., and this included all operations in connection with erection. The only way to reckon the item was to include all that the work cost. If the brick oven lasted for 15 years, there was no occasion to remove the stand-pipe during that period, and what was saved upon this item should be credited when calculating the cost of clay retorts. Taking it in this way, there was at least ¼d. per 1000 feet of difference between brick ovens and clay retorts, and this was equal to 115,000 feet of gas in each. He did not think quite so good a yield was obtained from brick retorts, and there might be a slight difference in the quantity of coke used in carbonizing. As to the question of coke, he found that this was very materially affected by the number of retorts which they had. If the works were under a great strain, the retorts were used for longer periods at a time, the effect of which was that the oven became worn, and the consumption of coke was increased. All these things needed to be taken into account if they were to arrive at the real difference in the cost of the two kinds of retorts.

Mr. J. COCKCROFT (Littleborough) had had some experience of brick retorts. At the time they were working them they thought they were doing excellently if they produced 9000 feet per ton. They worked them, he dared say, for four or five years, and when the retorts were pulled out they were as good as ever they were. The reason they pulled the retorts out was that they could not make them hot; they would have lasted 40 years at the rate they were going on.

Mr. E. LORD (Whitworth) said that at his works they used brick ovens like those on Mr. Chadwick's drawing, and they were carbonizing 42 cwt. of coal in 24 hours, and getting over 10,000 feet per ton. He thought they used a deal of coke to keep the retorts hot—15 cwt. per setting, or about 50 per cent. Mr. Chadwick said the cost of repairs was £6 a year, but he found that at his place the repairs cost double that amount.

Mr. J. CHEW (Blackpool) said he remembered distinctly that some statistics were furnished in a return which was made to the Institution, which clearly demonstrated that, so far as economy of fuel was concerned, clay retorts had the advantage. He had these retorts set in his furnaces, which were 7 ft. 9 in. wide by 7 ft. 9 in. high, the retorts being set three in a row on each side. With four-hour charges they took 2 cwt. each, and produced 36,000 feet of gas. The consumption of fuel varied with the quality of coal used. If Arley Mine coal was used, they got a much harder coke. If they employed soft coke, they necessarily used a great deal more; but if they used the coke from Arley coal, they had a great advantage over the other. Mr. Veevers recommended the experiment of keeping the tops of the retorts cool. He (Mr. Chew) tried this experiment some few years previously, the result being a great diminution in the quantity of gas. Mr. Chadwick did not tell them the quantity of carbon deposited. If he worked his retorts at a good heat, he (Mr. Chew) ventured to say that a great amount of carbon was deposited in the retorts, especially if he worked with a seal. Considering the space occupied by brick retorts, he (Mr. Chew) did not believe they would bear the least comparison with clay retorts.

Mr. G. SMEDLEY (Buxton) said in his old works he had one side of the bench set with brick retorts, and the opposite side with clay retorts, set in fives. The experiment he tried was so satisfactory that he decided to have the whole of that side set with bricks. The thickness of the bricks was 2½ inches, and the mouthpieces were fitted on with buckstaves, and held in that manner. The retorts were 24 inches wide, 14 inches high, and 7 ft. 6 in. long. In these retorts he could carbonize 2½ cwt. each. The clay retorts would do the same work, but they required renewing every two years. He had a stack of clay retorts as well as those of brick which he had mentioned, and he tried them alternately, but could find no difference. They each produced 9800 feet to the ton, but the bricks had the advantage in lasting longer. They were in use nine years, and at the end of this period they made as much gas as, if not more than, in the first year they were put in. As to the deposit of carbon, he found very little difference; the one required scurfing and cleansing as often as the other.

Mr. J. BOOTH (Southport) said that it was only during the last 18 months that he had had any practical experience of clay retorts. For 20 years his experience had been confined solely to brick retorts, and after the very short experience he had had with the clay, he was bound to say that he preferred the brick. The expense of building in the first place might be a little more, but he found there was a great saving in repairs, and, more than this, his experience of the clay retorts was that they were a prolific source of leakage. When they once became cracked they could never be repaired. His foreman had constantly to go round when the charge was drawn and make good the retorts, and after all he found that the yield from the clay retorts was considerably below what he could get from the brick retorts. As to the fuel account, he did not in brick retorts use much more than 20 per cent. of coke; and with reference to the formation of carbon, he found that it was less in the brick than in the clay retorts. So satisfied was he that brick retorts were better than clays, that he had during the past summer taken down 70 clay retorts and replaced them with brick ones.

Mr. A. C. FRASER (Bolton) had had a little experience in connection with the working of both descriptions of retorts, and he could, he said, speak with a certain amount of confidence of the fact that brick retorts, when properly constructed, were able to stand a greater amount of heat than clay retorts. He had used Cliff's ovens, and also Emmott's, and these, if properly constructed, were, in his opinion, a very scientific mode of carbonizing. A great deal depended upon the material of which the bricks were made, and the way in which they were burnt. They ought to be uniformly burnt—not too thick—and a good man ought to be set to work on them. He did not consider that a good brick retort should be more expensive, as regarded the consumption of fuel, than a properly constructed clay retort. It was only where they were badly constructed, and an obstruction was offered to the heat, that more fuel was required. If the edges of the bricks were left protruding, this was no doubt a serious evil, not only so far as the external part of the retort was concerned, but also as regarded the internal portion, for it there formed a basis for the deposit of carbon. He did not believe there was anything in the question of fuel, and as to longevity, he did not believe there was any comparison between the brick and the clay retorts. The brick ovens were far more economical in the matter of fuel. Altogether, if the three points he mentioned were attended to—if they procured the best material, properly burnt, and had it put together on correct principles by a practical workman—he thought they would obtain better results from brick retorts than they could with ordinary clay retorts.

Mr. B. ASKEW (Northwich) thought that one reason why clay retorts did not last long was that they were so bound round by brickwork that there was not room for expansion and contraction, and he believed that if some means could be devised of setting them so as to allow expansion and contraction to take place, managers would do better with clay retorts than with those of brick. He did not speak from experience, because he had never seen a setting of brick retorts in his life; it was a mere suggestion so far as he was concerned.

Mr. H. A. COLES (Todmorden) agreed with Mr. Chew as to the impression conveyed by the paper to which he had referred. He happened to be present when it was read, and the matter discussed. He had, he said, taken this subject, perhaps more than any other point of gas management, into his consideration, and he found that the ascending and descending flue was the proper thing. He could do his four-hour charges, and work off 54 cwt. of coal in 24 hours, and his results were 9715 feet to the ton. He used a coal which made a very good coke. As to the question of brick *versus* clay retorts, he had not had any experience, but he believed a clay retort would last three years. He agreed with Mr. Paterson that in brick ovens there was more space for the carbon to collect.

Mr. WOODALL said that at Cheltenham 11,000 feet and upwards of gas

were made per ton of coal years ago—long before the days of high yields, which were now so common.

Mr. D. Clarke (Ashton-under-Lyne) thought the object of the Institution had been illustrated that afternoon in the very free and candid discussion which had taken place, and which had elicited so great a variety of opinion. So far as his own experience was concerned, it had, he said, been principally with brick retorts, and in a very great measure on the system Mr. Newbigging condemned so strongly—the setting known as Emmott's. His production of gas, however, averaged 10,200 feet to the ton of coal. Brick ovens when properly set had some advantages, but whether they were the best that could be adopted was a matter of opinion. He at one time had four benches of seven clay retorts, but he was so tired of taking them out for alterations that he determined to adopt some other description, and he put in a setting of six brick retorts, the bricks and bottom tiles being 3 inches thick. He had these working side by side with settings of seven clays. The brick retorts were the first that he started, but the clay retorts had been scurfed more than once, while the brick retorts had not been scurfed at all. They carbonized 42 cwt. of coal in one day, which was equal to 7000 feet of gas per mouthpiece, with four-hour charges. The seven clay retorts he made do exactly the same quantity of work, so that the six settings of brick were equal to the seven settings of clay retorts. As regarded the fuel employed, he did not know that there was any material difference in the quantity used, and he did not see why there should be, from the fact that the brick retorts were no thicker than the clays, except where the springers were. From his experience in connection with brick and clay retorts, he should consider that the brick retorts were the cheapest, considering their longer life. As to the other advantages, brick retorts could be subjected to more rough usage than clay ones. Some of his brick retorts had been in use 12 years. When they were worn out he might adopt some other plan, but he did not think he should adopt clays. Mr. Newbigging had asked a question as to how the mouthpieces were secured. In his case there was a flange behind the mouthpiece, and the arched bricks came into this, as did also the bottom tiles, and to secure it they had a bar which ran across the top of the mouthpiece, and was secured to the buckstave. They thus dispensed with the front plate.

Mr. Newbigging, who desired to add to his previous remarks, said it was very important to know this, because in some places there was an immense plate covering the whole of the oven front, which was most objectionable. The dislike he had to using large brick or tile ovens was, that there was an immense area exposed to the cold air every time the charge was drawn, and the length of time required to draw an oven of this kind was very considerable indeed. The men had to use a rake about three or four times the weight of the ordinary rake, and the work was excessive beyond measure, while it took a much longer time proportionately to draw one of these ovens than to draw the ordinary retorts. Again, a large oven was not scurfed so often as an ordinary retort, because, there being ample space, the inconvenience of the carbon on the side was not felt. He had seen some of these ovens with carbon about 12 inches thick on the sides, and how was it possible, under these circumstances, to have, in an oven of this kind, the temperature which was required to distil the coal economically? Mr. Paterson reminded him also of the large amount of coal which was thrown into one of these ovens at each charge, the extreme depth of the coal, and the irregularity and inequality of the carbonization between the outer and the inner portions of the charge.

Mr. Clarke said that, as regarded the extra time in drawing and charging the retorts, he must admit at once that it took a man rather longer to draw an oven than to draw an ordinary retort, but at the same time he might say that a man would draw and put in a charge of 7 cwt. of material in ten minutes, so that there was no great objection on this ground. As to the carbon, of course it accumulated, and those who had to use these ovens knew that there was always a disadvantage where the carbon did accumulate, if it was only because of the extra fuel that was required, and they tried to keep it down as much as possible. He had seen blocks of carbon two feet thick that had been taken out of clay retorts. The coal did not lie very thick in brick ovens, as Mr. Newbigging supposed, because there was plenty of room for it.

The President observed that the discussion had been a lengthy one, and had been productive of great variety of opinion. He had no idea there were in the Institution so many advocates of brick retorts, and it seemed as if one need not to be ashamed of expressing any predilection for these retorts. Although the evidence in favour of them was very good and very true so far as it had gone, he did not think it was all the evidence that ought to be given. It had been mainly with regard to the life of the retort. As Mr. Veevers stated, it did not necessarily follow that length of life meant economy. There was also another aspect in which they ought to look at the question of retort-setting, and this was in relation to the men who had to work the retorts. There was also the question of the quantity of gas which retorts would produce, and further than this the amount of fuel it would take to heat the retorts while they were at work. He thought the subject might fairly be divided into these four heads, and it could not be fully considered unless looked at from all these points. Mr. Booth's statement that he had heated brick retorts with a consumption of only 20 per cent. of fuel surprised him. He had no idea of any such small consumption of fuel either with regard to brick or clay retorts. The consumption of fuel at the Halifax Gas Works—and they worked as high heats as they could get—was from 26 to 28 per cent. This was for clay retorts, and, with the exception of the single statement of Mr. Booth, it was, he believed, very much lower than any amount of fuel mentioned by Mr. Chadwick, or any gentleman who had used brick retorts. He thought, however, that, considering the question from this point of view, experience gained from the working of both brick and clay retorts had shown that the consumption of fuel was less in the clay retorts than in those of brick. He was not saying this without proper deference to Mr. Booth; but his (Mr. Booth's) experience was the experience of one man against many. In a case of this sort he (the President) did not think they were justified in pursuing any system of carbonizing while they had another which would reduce the consumption of fuel nearly one-half. With regard to the question of the quantity of gas produced, he did not agree with Mr. Woodall, who, if he remembered right, said that brick retorts could produce as much as clay ones under similar conditions. The experience of all the men he had ever heard speak on the subject, as well as of those who had written upon it, was opposed to this. As to the effect upon the labourer, large ovens were undoubtedly a positive cruelty to the workmen. There could be no reasonable justification for the use of an oven that subjected the workmen to such a strain as to practically limit managers to one class of men. A man who was not of a robust constitution could not undertake the work at all, while if they had a reasonable size of retort, whether of brick or of clay, they could extend the area from which they could draw their labour, thus enabling them to get a steadier and better class of men. There was also the question of securing the mouthpiece. Mr. Clarke had shown from his experience that the mouthpieces of brick retorts could be secured with almost as little ironwork as was used in connection with clay retorts; but the drawing before them showed an elevation with an iron front. The amount of radiation of heat from one of these settings must be something enormous. If they went into a retort-house and walked past a setting with a front of this kind, and then past a setting where there was only the mouthpiece of iron, the remainder of the front of the setting being brickwork, they would quickly perceive the difference; and he certainly thought the iron front was objectionable, because it radiated a lot of heat which was wanted in the furnace, and, besides, made the retort-house more uncomfortable for the workmen. As to the question of the cost of the two settings, he could not go into it just then, because he had not worked it out in the way Mr. Chadwick had; but the meeting were indebted to that gentleman for having put on record the figures he had, because they would enable members to form some data of comparison between what they were doing and the results achieved by Mr. Chadwick. This was certainly most valuable information for them all. He should, he added, like to say a word or two more upon the question of large or small makes. This was a subject that was being very much discussed in the Journal of Gas Lighting, and some worthy members of the profession were differing as to what was right and what was wrong. This question formed part of the subject of retort-setting. There was no doubt that the retort-house formed the basis of their success, and much of their success, whether it were an infallible test or not, would depend upon what was being done in the retort-house. That a man might do himself great injury by trying to get a large yield of gas per ton, and throwing away more money than he could obtain from what he put into the gas, was, no doubt, a fact. Many managers had done so, and it could easily be done again. Still he thought there was a reasonable limit to which they might all aspire. He did not believe, in spite of what was said to the contrary, that any increase in the quantity necessarily meant deterioration in the quality of gas. He believed it was possible to make worse gas with 8000 feet per ton than with 10,000 feet, from the same coal, because if they had a light yield per ton of coal it was accompanied by a corresponding increase in the amount of tar produced. The question, then, to be asked was what the increased quantity of tar was composed of. It was composed very largely of those hydrocarbons which it ought to be the aim of every gas manager to retain in the gas. He believed there was a reasonable limit to which a man might aspire, and up to that he thought it was a very fair criterion to say the retort which would give a large yield of gas at a low cost, comparatively speaking, was the best one under any set of conditions, and they must not lose sight of this, whether the retort lasted twenty or only two years.

Mr. Chadwick, in reply, said he did not think the deposit of carbon inside the brick retorts was any more than it was in clay retorts, judging from those of the latter description which he had seen. He had brick retorts which had been working since June, and they had not had anything done to them in the intervening period, except just cleaning the mouthpieces. As a rule, it did not become necessary to remove the carbon more than once during a season's working.

Mr. Paterson: What pressure have you?

Mr. Chadwick said he had as nearly as possible a level gauge within the hydraulic main. The deposition of carbon was not at all great. Mr. Paterson had asked him whether more fuel was used in heating brick retorts, after they had been in use some eight or ten years, than in their first season of working. He (Mr. Chadwick) found very little difference. He had tried an experiment with reference to this point during the past month, and he found that about the same quantity of fuel was used in a retort-setting which was in its first season, and one which had been in use twelve years. Mr. Newbigging asked a question as to the fastening of the mouthpieces. They were fastened with bolts going through the front plate. The bricks used were 3 inches thick, except in the springer next to the furnace, which was about 1¼ inches thicker. The bottom tiles were also 3 inches thick. Mr. Veevers said something about the length of time a retort should last. In his calculations he took both brick and clay retorts as working the same period each season. Mr. Woodall mentioned the fact that in his (Mr. Chadwick's) comparison he had not taken credit for some little advantages in favour of brick retorts. He certainly had not taken these into account, and when added to his figures the result would show more favourably for the brick retorts in point of cost. Mr. Cockcroft had told them he could not get more than 9000 cubic feet of gas per ton of coal from the brick retorts which he had had in use. He (Mr. Chadwick) should never use those retorts if he could only get 9000 feet with them. He had an average of over 10,000 feet. There must have been something radically wrong in the setting of Mr. Cockcroft's retorts, or otherwise he would have produced more gas.

Mr. Cockcroft: They were 5 or 6 inches thick.

Mr. Chadwick said the quantity of coke which Mr. Lord used was excessive, and the cost of repairs he had set at double what he (Mr. Chadwick) gave. The amounts given in his paper were taken from the actual expenditure of the last twelve months. Mr. Chew spoke of the consumption of fuel. Mr. Chew's consumption of fuel with clay retorts was certainly less than his (Mr. Chadwick's) with brick; but he had hopes that he should be able to reduce the fuel. He was using fire-bars which were 5 feet long, but was reducing the length, and found he could reduce the quantity of fuel considerably; instead of using 40 per cent. he should be able, he thought, to reduce it to 30 per cent. The back part of the bars sometimes became bare, and allowed a large inrush of cold air, which was very detrimental, and by shortening the bars he should be able to remedy this.

Mr. W. A. Walker (Elland) read a paper on

TOWER SCRUBBERS.

At our last meeting, Mr. Harrison Veevers kindly put before us some results of the working of the "Standard" washer-scrubber of Messrs. Kirkham, Hulett, and Chandler. My experience having been confined exclusively to tower scrubbers, I propose to lay before you a few of the results that have followed upon the erection of a pair of this description at the Elland Gas-Works.

My first duty is, I think, to describe to you the arrangements previously existing for the extraction of ammonia at my works. Before doing this, however, permit me to state that our maximum winter's make per day of 24 hours has not yet exceeded 300,000 cubic feet. The scrubbers we had previously in use consisted of two cast-iron vessels 16 feet high by 5 ft. 6 in. diameter, and had a capacity of 1·26 cubic feet of scrubbing material for every 1000 cubic feet of gas made in 24 hours; or, if I may so describe it, the gas was allowed to remain in contact with the scrubbing material 1·82 minutes. I suppose it is an open question, and I believe a great diversity of opinion exists, as to the exact amount of scrubbing capacity it is desirable and economical to employ; however, about the middle of the year 1878, my Directors having in view the increasing value of ammoniacal liquor, decided on taking a rather long stride, and unanimously resolved on the erection of a pair of tower scrubbers 45 feet high by 9 feet diameter. This gave me 9·54 cubic feet of scrubbing material for every 1000 cubic feet of gas made, and allowed the gas to remain in contact with the material 13·74 minutes. Doubtless you will put this down as a very long jump indeed. However, about the month of November, I think it was, in 1878, the scrubbers were in complete working order, so that I can give you the results of one full year's working—that for the year 1879—and place

them in comparison with a statement of the results obtained during an average of, say, the three preceding years, 1876-8. I may first of all mention that the scrubbers are filled with wood boards ⅜-inch thick, on the Livesey principle, placed ½-inch apart, and crossed alternately every tier. The average quantity, then, of ammoniacal liquor produced per annum for the three years mentioned amounted to 24 gallons of 10-oz. liquor per ton of coal carbonized, and the cost of purification, including lime and labour, for the same period, was 0·57d. per 1000 cubic feet of gas made. The quantity of ammoniacal liquor produced for the year 1879 was increased from 24 to 39¾ gallons of 10-oz. liquor per ton of coal carbonized, and the cost for purification was reduced from 0·57d. to 0·45d. per 1000 cubic feet.

Now as to the money part of the question. The net gain, after making deductions for the increased quantity of coal carbonized, and for some additional price obtained by the sale of the liquor, amounted to £250 for the year, and though apparatus of this description is of a somewhat costly character, I hope to be able to report to my Directors in, say, from four to five years time, that the scrubbers have paid for themselves. Since their erection I have worked them in various ways with a view to discover the best means of utilizing them as far as possible for eliminating not only the whole of the ammonia, but also as high a percentage as possible of the foul gases, and so reducing the work to be done by the purifiers proper, and I find that by pumping over in the first scrubber, and running pure water into the second one, I obtain the best results.

Very recently I determined to discover exactly what was to be gained by pumping, and with this object in view I caused clean water only to be run through the scrubbers, and ceased pumping for several days. My contract being for liquor of 5° Twaddel, I, of course, had to regulate the supply of water so that the issuing liquor should be of that strength, and I found I attained this, and was able to run through the scrubbers 20 gallons of pure water per ton of coal carbonized. From other sources—viz., the condenser, &c.—12 gallons per ton of 5° Twaddel was produced, making in all 32 gallons. I found that upon this plan I could purify the gas made from 48 tons of coal by one ton of lime, and in an analysis of a sample gallon of the liquor produced in this way the constituents thereof were found to be as follows:—Ammonia, 1928·4 grains, or 6·07 lbs., per ton of coal carbonized; carbonic acid, 3142·89 cubic inches, or 58·20 cubic feet, per ton of coal; and sulphuretted hydrogen, 400·64 cubic inches, or 7·41 cubic feet, per ton of coal. The total quantity, therefore, of foul gases eliminated amounted to 65·61 cubic feet per ton of coal. I then recommenced my usual method of working—viz., running clean water through the second scrubber and pumping it through the first one in combination with the condenser liquor. I then found I was always able to maintain the strength of my liquor at the requisite 5° Twaddel, and admit at the same time 28 gallons of clean water into the scrubber, so that with the 12 gallons I stated was produced from other sources, I found myself with a total quantity for sale of 40 gallons of 5° Twaddel liquor per ton of coal carbonized. I also found that with one ton of lime I could purify the gas produced from 70 tons of coal, and the constituents of a sample gallon of this liquor were found to be as follows:—Ammonia, 1155 grains per gallon, or 6·60 lbs. per ton of coal; carbonic acid, 3684·89 cubic inches per gallon, or 85·29 cubic feet per ton of coal; and sulphuretted hydrogen, 488 cubic inches, or 11·29 cubic feet per ton of coal, making a total quantity of foul gases eliminated 96·58 cubicjfeet per ton of coal, or a gain over the previous method of working of 0·53 lb. of ammonia, and of foul gases 30·97 cubic feet per ton of coal carbonized. These results, to my mind, prove conclusively that with a sufficient capacity of scrubbing material, and the liquor made to do the full amount of work of which it is capable, a very great deal may be done towards the complete purification of gas.

In a valuable paper read by Mr. Frank Livesey before the British Association of Gas Managers in 1878, on some experiments with ammoniacal liquor as a purifying agent, I find it stated that every ounce strength of ammonia in the liquor should show, if entirely combined, some 416 cubic inches of foul gases. This, of course, for 10-oz. liquor, would be 4160 cubic inches. You will have observed that the total quantity found to be contained in my second sample was 4172·89 cubic inches per gallon; so that, in the ordinary way of working, I cannot expect to do much more than I am now doing.

I think this is a subject worthy of our best attention as gas managers, especially having regard to the high prices that can now be obtained for ammoniacal liquor throughout the country.

With regard to the matter of complete purification in closed vessels, I should be much pleased if one or other of our members would give us a paper on the subject at an early future meeting, as it is a matter of such a highly interesting character. Doubtless if purification could be economically accomplished in this manner, it would be welcomed by gas managers generally as a very great boon; and when we come to consider the talented men who are making this subject their special study, I think some, if not all of us, will be privileged to see it *un fait accompli*.

Discussion.

Mr. Chew said he did not know what kind of coal Mr. Walker used, but evidently it was a coal which contained a very great deal of ammonia. In making a comparison on this subject, one of the first questions to be considered was that of coal. He used two 35-feet scrubbers and clean water, but he did not know that it mattered what kind of scrubbers were used, so long as they took out the last trace of ammonia. If they took out all the ammonia that was in the gas, and used it in scrubbing or washing to absorb the carbonic acid and sulphuretted hydrogen to its fullest extent, they could not do more. As to the amount of liquor, this, of course, depended upon the amount of water in the coal used, and the quantity of ammonia in it. Mr. Walker said a good deal about the purification of gas. It had been put forth by the late Dr. Letheby that there was no better means of purifying gas than by washing it with strong ammoniacal liquor, and there was no doubt that it would extract the sulphuretted hydrogen and carbonic acid. Ammonia was said to be the best purifier that they could possibly have, if they had only enough of it; but, unfortunately, they had not. He could only say he was surprised at a yield of 39 gallons of liquor to the ton of coal; it was something he had never heard of before.

Mr. Paterson was not sure that the quantity of liquor depended at all upon the coal used. His experience with coal was rather against this, and whatever class of coal it was, they would not find very much variation in the quantity of tar or liquor produced, provided the coal was distilled at its proper temperature. He took it that whatever excess in the quantity of liquor had been obtained by Mr. Walker was due to other causes altogether. He used, in fact, a large quantity of pure water, and by this means increased to a very large extent the quantity of liquor. There was no doubt that by using a smaller quantity of water, or using nothing but liquor, he would bring up the specific gravity to something like 12° or 14° Twaddel. He did not do this, but worked his second scrubber with water, which gave liquor at 5° Twaddel. It was simply a question of taking out the whole of the ammonia from the gas, but on any other principle they would probably not do so; and it was advantageous to do it, not only because of the value of the ammonia, but to save the purifiers for other purposes. The purifying materials which they had would not tell upon ammonia, and to take out the whole of the ammonia before the gas went into the purifiers was certainly a point which required consideration. The large quantity of 40 gallons was certainly beyond all previous experiments, but he should not call in question the accuracy of Mr. Walker's observations. He was very glad to know that Mr. Walker was able to do it.

Mr. Newbigging said he had listened with much satisfaction to the paper read by Mr. Walker, because it bore out views which he himself entertained, and also because it agreed with his own experience of tower scrubbers. The object intended to be accomplished by the scrubber as originally introduced was the extraction of the ammonia impurity from the gas. This work the tower scrubber—if made of the proper height, filled with suitable material, and supplied with a good water distributor—did most effectually. But it would be admitted without question, now that the functions of the apparatus were better understood than was the case some years ago, that it was but an indifferent and unsatisfactory scrubber which would not also, in addition to taking out the ammonia, arrest a very considerable proportion of the carbonic acid and sulphuretted hydrogen. The process was, as they knew, a chemical one, so that it was not correct to say that the chemistry of purification began in the lime and oxide purifiers. The ammonia combining with carbonic acid formed carbonate of ammonia, and with sulphuretted hydrogen sulphide of ammonium. A good scrubber materially assisted the purifiers. It was sometimes objected to tower scrubbers that their height was objectionable. At the last meeting some of their members congratulated themselves on being able to put their scrubbers under cover. In his opinion, however, the height of the scrubber was its greatest recommendation, because it admitted of almost unlimited surface with the least possible expenditure of ground space. If the water-distributing apparatus at the top were covered, and the precaution taken that the water entering was not under 55° Fahr., it was sufficient. The same precautions were required in any scrubber, whatever its form. As a matter of fact, they knew that the temperature of the gas was not affected to any appreciable extent in passing through the tower scrubber, even in the coldest weather. On the question of cost there was a positive advantage, in his opinion, in adopting the tower scrubber. The tower cost from £900 to £1000 per million cubic feet production per day, and if it were taken into account that only the minimum of power was required to work the distributor, it would be found in all respects the cheapest and most desirable form to adopt. A moment's consideration of the question would show the marked superiority of the tower over any other form of scrubber that could be named. The gas entering at the bottom of the vessel met the water as it trickled down over and amongst the filling material. Every single particle of water which entered the vessel performed its share in the work of purification. And not only so, but every drop was being constantly broken up and made to present a fresh surface to the passing gas; and further the whole of the water continued in intimate contact with the gas from the moment it entered at the top to the time it made its exit at the bottom. For these reasons there need be no surplusage of water, and the resulting liquor was of the greatest strength attainable, and in that condition exerted a powerful influence in arresting the other impurities. The chief points to be observed in the working of the tower scrubber, whether it was filled with coke or boards, or other material, were, to be careful that the whole of the tar was eliminated from the gas previous to the gas entering the scrubber (and for this purpose a good washer could be employed), and to see that the distributing apparatus was efficient, always at work, and never allowed to remain out of order. There was just one other point he would refer to. The tower scrubber, besides all its other advantages, had a good appearance. Some of these scrubbers, as now designed, were positively handsome, and did not entail increased cost. This would not be worth mentioning if they were not an efficient appliances. On the other hand, some of the squat machines more recently introduced were the very embodiment of ugliness, and surely appearances should count for something, even in gas-works.

Mr. T. B. Ball (Leeds) remarked that as Mr. Walker sold his liquor by the Twaddel standard, the quantity of carbonic acid he got into it did not perhaps matter; but if he had to sell it by the quantity of ammonia it contained, he would not get 40 gallons of 10-oz. liquor. The strength was fallacious, and was really due to the percentage of carbonic acid which the liquor contained.

Mr. Lord said he had two scrubbers—one 16, the other 40 feet high. The former was filled with coke, and the latter with boards, and the liquor was run through the second scrubber from the first. He had gone through his last year's account and found that he made 35 gallons of liquor per ton. Before the second scrubber was erected, the make was about 20 gallons, and now they had 35 gallons of 5° Twaddel.

Mr. Booth mentioned that in one case liquor tested at 5½° Twaddel only contained a little over 1 per cent. of ammonia, and in another case he found that liquor giving the same strength Twaddel contained 3 per cent. of ammonia. He thought it was within the reach of all the members to produce 40 gallons of liquor per ton, when they saw that the actual quantity of ammonia was so small.

Mr. Fraser had no doubt the scrubber was highly advantageous in reducing the cost of purification. In connection with the scrubber at his works, he said, they used Livesey's washer. Prior to using it, although they had a tower scrubber 60 feet high and a very efficient distributor, they could not eliminate the last trace of the ammonia, but since they had had the washer they could not only eliminate all the ammonia, but the percentage of ammonia in the liquor had been increased. They formerly obtained only about 28 gallons of 5-oz. liquor, but some little time ago he sent a sample of his liquor to a chemist, who said it showed a larger percentage of ammonia than many samples of liquor of 6° strength. This showed, as had been already remarked, that it was the other constituents it contained that made Mr. Walker's liquor so strong.

Mr. C. Eastwood (Batley) said, in the first place, it was a fact that coal did differ in the quantity of ammoniacal liquor taken from it. He paid great attention to this matter in his experiments with reference to coal and coal seams, and, as the members knew, he gave some of the results in the paper he read at the last meeting of the Institution. At his works they did not always purchase coal from one pit, and he had noticed that when he took a certain quantity of coal of a different kind to what he had been using, it invariably altered the quantity of ammoniacal liquor produced, and he could quite corroborate the statement of Mr. Ball that the quantity of ammonia in the liquor, as tested by Twaddel's hydrometer, was fallacious. When he recently made a contract with reference to his liquor, the contractor wished him to take either the distillation process of testing the strength, or the ordinary Twaddel test. He need not say he chose the latter.

Mr. Coles could bear out Mr. Eastwood's remarks from a test made a day or two before the meeting on a sample of ammoniacal liquor obtained from other works than his own. He had, he said, noticed the liquor to be somewhat turbid, and on testing it by Twaddel's hydrometer he found it to stand at 8½°, while the liquor made at his own works stood at 6°. When the turbid liquor had undergone filtration it stood at 6°. He thought this showed that sulphuretted hydrogen or other impurities held in solution

must influence the use of the hydrometer as to finding the true value of gas liquor.

The PRESIDENT reminded the members that at the last meeting he said he was surprised that something more had not been said upon scrubbers as effective purifying agents. He was exceedingly surprised that Mr. Chew should say that if they took out all the ammonia this was enough. He considered it was not enough. They were not justified in stopping there. If the scrubber could be made to do more, it was their bounden duty to see that it did more. Mr. Walker had shown them that he had reduced the cost of purification 21 per cent.—from 0·57d. to 0·45d.; that was to say, that where they were spending £500 in purification he only spent £400. This was a substantial result to have accomplished with his scrubbing apparatus; and if Mr. Walker could do this, he (the President) thought they were not justified in not doing it. Mr. Walker not only took out the ammonia, but something more, and on the present system of buying ammoniacal liquor he sold it. This was not Mr. Walker's fault, nor the fault of the scrubber. His (the President's) own opinion was that it was a very important thing indeed to be able to do so much work with the gas before it reached the purifier, and at the same time to be able to sell the product. The latter would, however, soon be done away with if they all obtained the same results as Mr. Walker. He thought the purchasers of liquor would very soon give up using the hydrometer as a test, but not for the sake of the neutralization test, which simply gave the quantity of free ammonia in the liquor. If the latter were adopted, he thought Mr. Walker's liquor would come down very low indeed. Only two tests for ammoniacal liquor had obtained up to recent years—the Twaddel test and the neutralization test. The neutralization test gave the quantity of ammonia in a free state, while the other test gave the quantity in a fixed condition. Mr. Walker had obtained the full benefit of it; he had found that he could take a rise out of the sulphate manufacturers, much to the advantage of the Elland Gas Company, no doubt. Mr. Walker had told him what he had been doing from time to time, and he believed that such work could be done by every one, if a similar kind of apparatus was in use, and that a great amount of money might be saved by the adoption of proper scrubbers. He had himself, as they knew, tried one or two kinds of washers. He had a washer in use which, according to Mr. Chew's standard, was perfection, for it took out all the ammonia, though it would not do anything like what Mr. Walker's apparatus did. As to the coal employed, Mr. Paterson had stated that the quantity of liquor would be pretty much the same from all kinds of coal, if they were distilled at their proper distillation point. This would account for the fact that in many instances there was a larger yield of liquor sometimes because they had distilled the coals all one way, and mixed the ammonia with other matters. As to the coal which Mr. Walker used, they used the same at Halifax. He (the President) had worked for days and days together on this particular class of coal, and then he had gone on to another West Yorkshire coal, and had found that while the same quantity had been used the liquor had gone up 1½°, and when he went back to the coal which he had been using before he found, in a similar way, that the strength of the liquor had dropped 1½°. The coal which Mr. Walker used was, therefore, calculated to produce a low quality of liquor compared with other West Yorkshire coals. It was the Flockton seam which Mr. Walker used, and this coal did not yield a large quantity of impurities. One of the advantages of the scrubber over the washer was the length of time the gas remained in contact. As Mr. Newbigging had stated, it remained in contact the whole of the time from its entrance into the apparatus until it left it. It was a chemical action which went on, and if they expected any combination to take place they must give the gas sufficient time. The gas being of necessity introduced at a low temperature, any chemical action which it was desired to bring about could only take place slowly; it being a well-known law, to which there was no exception, that chemical action took place more slowly at a low temperature, and quicker at a high one. They could not, however, introduce the gas at a high temperature, for the reason that the solubility of ammonia in water varied with the temperature of the water in which it was to be absorbed. If they put the gas in hot, they would find that the ammonia flew off almost as rapidly as it was absorbed, and therefore the only alternative that they had, if they intended to go in for chemical action, was length of contact, and his own opinion was that it could only be obtained in that way. Of course, they could obtain the same result by letting the gas travel a long distance horizontally; but by doing so they occupied a large portion of the site of the works. He did not know how it was that tower scrubbers had recently grown into disfavour, unless it was because gas managers were imbued with the idea that it was only necessary to take out the ammonia, and that nothing more was required. His opinion was that they must take out everything they could. There were different kinds of tower scrubbers, and he believed the opinion of many gas engineers had been that they did not take out all the ammonia, and in this respect they might have grown into disfavour; but he thought the tower scrubber would take out the ammonia if it were properly filled, with a proper distributor to keep it in order. It was the duty of the manager to see that this was done. He had gone carefully over this ground again and again. He had a washer which he thought was his own until Mr. Eastwood visited his works, and said he had had one like it in use for five years, and if he had any prejudice it would be in favour of this machine; but in spite of this he came to the conclusion that the most efficient apparatus was the tower scrubber.

Mr. CHEW took it that it was the ammonia which was the purifier, and not the water—that it was the ammonia which acted on the sulphuretted hydrogen, and not the water. If there was a large quantity of ammonia, it would, he said, take out the sulphuretted hydrogen and carbonic acid; but if it was to be done altogether by the water, this was something new to him. The great difficulty with which he met was the freezing of the taps in winter-time. He had not a washing arrangement, but certainly if the gas could be purified in a close vessel which could be kept from freezing it would, in his opinion, be an advantage over the scrubber.

The PRESIDENT observed that he did not say it was the water that did the work, but the water happened to be the medium which conveyed the ammonia. The ammonia existed in the gas in a gaseous state, but he believed that when it was in solution it acted with more effect. It was a question of application, that was all.

Mr. CHEW: The inference you drew from my remarks was the reverse of that.

Mr. WALKER, in reply, thanked Mr. Paterson and Mr. Newbigging for their kind observations in support of his paper, and remarked that Mr. Ball said something about the number of grains of ammonia being less in No. 2 sample than with the clean water process. This really showed the value of making use of ammoniacal liquor as a purifying agent, for, as the analysis showed, the ammonia was replaced to a certain extent by sulphuretted hydrogen. The coal which he used was, as the President had mentioned, the Flockton seam, and he (the President) had told them the properties of this coal for yielding ammonia. He (Mr. Walker) attributed the excellent results which had been achieved firstly to the amount of scrubbing capacity employed, and secondly to the way in which the liquor was pumped over, and the manner in which it was distributed through the scrubber. If they took care to maintain at all times a thoroughly wetted surface, and had sufficient capacity, they would obtain the same results. A great deal depended upon the length of time the gas was allowed to remain in contact with the scrubbing material, and if they had a desire to simply take out the ammonia and nothing else, they could do this very easily. He could do it with 20 gallons of pure water per ton of coal; but his object was to purify the gas as far as possible before it entered the purifiers proper. The object of the paper was to show this, and to prove that by efficient scrubbing a great amount of purification could be done, and the money results proportionately increased.

[Mr. T. B. Ball, of New Wortley, Leeds, had promised to read a paper entitled: "Is the Elimination of Light Oils from the Tar, and their Retention in the Gas, Desirable?" The afternoon had, however, worn away, and the President suggested that, as many members would have to leave before the paper could be discussed, it was desirable to postpone it till the next meeting. This opinion was endorsed by the meeting, and Mr. Ball assented to the arrangement proposed.]

The PRESIDENT then moved a vote of thanks to Mr. Chadwick and Mr. Walker for their papers, and to Mr. Ball.

Mr. FRASER seconded the motion, which was supported by

Mr. PATERSON, who remarked that the subject with which Mr. Ball proposed to deal was one of very great interest, and the paper would, he hoped, be read at the next meeting.

The motion was carried with applause, and the three gentlemen included in it very briefly responded.

A vote of thanks to the President for his conduct in the chair was adopted, on the motion of Mr. NEWBIGGING, seconded by Mr. CHEW, and the proceedings ended.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday*.

The town of Montrose seems to be in a somewhat excited condition at present, owing to the decision of the Town Council to apply to Parliament for powers to acquire the gas-works. For some reason or other—it is not very obvious from the published reports of the proceedings—an active opposition to the carrying out of the scheme has been roused in the burgh; but if the opposition does not speedily resolve into "thin air," its leaders, at any rate, will receive such a check at the approaching poll as will surely carry conviction to their minds that the sympathies of the greater portion of the community are with the Provost and the majority of the Council in their efforts to promote the general interest. Meanwhile, however, the somewhat disagreeable duty has been imposed upon Provost Jaap of rebutting certain misleading statements, and of explaining away a mountain of figures which Mr. Durie, one of the Council, had laboriously piled up to frighten his fellow-townsmen into compliance with his opposition. At a meeting of the Town Council on Thursday last, the Provost discharged his duty with great credit to himself, and, I should think, to the utter discomfiture of the ringleader of the opponents of the scheme. Mr. Durie produced figures to show when first the scheme was propounded, some three weeks ago, that the town was burdened with debt to the amount of about £30,000. The Provost proves this to be an exaggeration of nearly £11,000, and then he quietly proceeds to discuss the financial position of the town in the event of the gas-works being acquired. He does not by any means "draw the long bow." In plain figures, he demonstrates that it may be three or four years before the town will begin to feel any appreciable benefit from the change, and he is content—nay, indeed, anxious—to carry out the transfer even on that footing. It is plain that the Provost does not belong to that class of selfish local legislators who think they have sufficiently discharged their civic duties by attending to the immediate present, and who imagine it is adverse to the decrees of Providence to consider the morrow. He looks hopefully forward to the time when, as the interest on capital decreases, the town will be supplied with gas at a much lower figure than at present. Even taking the most serious view of the position of affairs, he feels convinced that the Corporation would be able to take over the gas-works and manage them in such a way that it will not be found necessary to levy any assessment for gas purposes. Again the "red herring" of electric lighting was drawn across the scent; but it failed of its purpose. I am afraid that if Dean of Guild Scott bases his reputation upon the accuracy of his prophet-like utterances, not a shred will be left to him at the end of that period when gas is to be snuffed out. In order that his words may go down to posterity, and that his name may be enrolled on the scroll of Fame alongside those of the great Marquis of Montrose and Joseph Hume, his fellow-townsmen, I here quote them: "There is a great probability that gas as a lighting medium will ere long be superseded, and we should therefore be cautious." He then referred to places where the electric light has been introduced, and in answer to a Commissioner who had dared to say that this light would never be of any use in lighting dwelling-houses, the sententious Dean observed that these were almost the very words his father had used 50 years ago in regard to gas. From this one point it is very evident that the Dean of Guild did not receive his prophetic mantle from his father. But the Dean went a step further than this. Hitherto the most timorous gas director has consoled himself with the fact that if electricity should ever become a competitor with gas for lighting, coal would never cease to be distilled, if for nothing else than what are now regarded as bye-products; but the Dean is of belief "that before the end of the century what they now proposed to pay £25,000 for would not be worth £5." Although this statement was received with laughter, it is very sad. I trust that the Dean will live to see his prophecy turn out incorrect. Meanwhile, it is plain that the town must decide one way or another. I have little fear that the Provost will be liberally backed by the majority of the community.

A movement has been instituted in Aberdeen, having for its end the establishment of a gas exhibition. As in Glasgow, the originators of the scheme are the members of the Philosophic Institution, and they have resolved to head a guarantee-fund with a subscription to the extent of £50, if the matter should receive the support of the public, and if a good local Committee is formed. This proposal has brought out the fact that on the 25th of October last Mr. Smith, the Gas Superintendent of the City, received a letter from a prominent citizen, offering to get up an exhibition, admission to which should be gratuitous; but this offer is conditional upon the Gas Committee agreeing to supply gas connections. The idea is novel; but I am afraid that in order to make such an exhibition worthy the city of Aberdeen, where a lively interest has always been manifested in matters pertaining to gas, a good deal of expense would require to be incurred, to meet which a small charge for admission would almost be necessary. I have no doubt whatever that if an exhibition were got up the Corporation would not only make the connections, but would supply the requisite amount of gas gratis. In doing this a Corporation is only advancing its own interest. It may be that it is casting its "bread upon the waters," but the ultimate result must be substantial gain. All who are interested in gas matters will wish success to the movement.

Within the past week many of the towns in the east and north-east of Scotland have been directing their attention to the question of water supply. Recently ascertained facts go far to show that where there is abundance of pure and wholesome water the scourge of epidemics is not felt, and that where the supply is stinted and of doubtful purity, the health of the community greatly suffers. This has been notably the case in Edinburgh. I have, in previous communications, shown that, although the water supply of this city is amply abundant, its quality has not afforded that degree of satisfaction which was anticipated. At a meeting of the Edinburgh Water Trust, on Thursday, there were sarcastic references made to "Leslie's tincture—Mr. Leslie being the Engineer of the works—and "Leslie's compound." In order to quiet people's minds and bring about a better feeling with respect to the water, the Trustees have engaged Professor Crum Brown and Mr. J. T. Buchanan, Lecturer on Chemistry at the University, to analyze samples of the water. Although the analysis may show that the water is wholesome enough, it will not, for some time at any rate, drive from the recollection of the citizens the pure crystal-like waters which they formerly received from the Crawley Springs. From the proceedings of the Trust it seems that the amount of money borrowed on mortgage since July 30, 1874, under the Acts of 1874, 1876, and 1880, has been £524,800, the amount in the bank is £32,442 12s. 1d., and the amount the Trustees still have power to borrow under the existing Acts is £95,100.

The town of Stirling, which was reduced to such straits during the recent water famine in Scotland, has resolved to be better provided in future for dry seasons. Last week the Water Commissioners resolved to proceed with a new Water Bill, and they estimate that the proposed works will cost about £10,000.

Elie is a pretty little watering town in the East Neuk of Fife, and hitherto its inhabitants, as well as the swarm of visitors who flock thither during the summer months, have been dependent for their water supply upon the few wells that are scattered up and down the town. Certain of the residents desired that Elie Liberty and Williamsburgh should be formed into a special supply district; but as the Local Authority refused to comply with the request, an appeal has been made to the Sheriff, who has taken time to consider his judgment. It was contended on the one side that there was at present an ample supply of water, and on the other that the Local Authority had failed to perform their duty in refusing to form the localities mentioned into a water supply district.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

At the last meeting of the Dean of Guild Court at Govan, a burgh of upwards of 40,000 inhabitants in the south-western suburbs of this city, there were submitted for approval the plans of new gas-works to be erected in connection with Messrs. John Elder and Co.'s works at Fairfield, the largest private shipbuilding and marine engineering establishment in the world. The erection of the works, the plans of which were passed, is to be done under the superintendence of Mr. Miller, of Thomson Street, Govan, who is said to have patented a new process of gas-making by which a considerable saving can be effected. The new works will embrace a retort-house, having two benches of five retorts each, together with a gasholder 40 feet in diameter, and contained in a concrete tank 21 feet deep. It is stated that in this case Mr. Miller undertakes to supply the gas free of charge, his opinion being that by his new process he can utilize the products so as to cover all expenses. A claim is made in favour of the process, that from common coal dross or "triping," 28-candle gas can be made to the extent of 7000 cubic feet per ton. Various other advantages are claimed in connection with it, and it is stated that Mr. Pearce, the enterprising head of the firm of Messrs. Elder and Co., has not only examined the process thoroughly, but that he is convinced of its superiority over the older or ordinary method, and is doing all in his power to give it a fair trial. Unless I am mistaken, this same process was in operation at Messrs. Crum's cotton-printing works at Thornliebank, where it was examined, at the request of the patentee, by some members of the Committee of the West of Scotland Association of Gas Managers within the last two years. When it is in a fair way of working at the Fairfield establishment, I hope to have an opportunity of carefully examining and reporting upon it. Meantime I am not in a position to express an opinion regarding it.

An extensive fire took place last Sunday morning at Lounsdale Bleachfield Works, near Paisley, the origin of which is stated to have been in a small gas-works connected with the establishment. The damage is said to be about £20,000.

The whole contract for the building of the new gas-works referred to last week as about to be erected at Port-Glasgow for the purposes of the Clyde Lighthouses Trust, has been secured by a Greenock firm. At the gas-works in the adjoining town of Gourock there are still some extensions to be made. These are now about to be taken in hand.

It seems that the voting of gas profits to town improvements is now exciting attention among the ratepayers of Glasgow. On Tuesday last the subject was taken up and considered at a meeting of the Committee formed to look after municipal affairs on behalf of the Tenth Ward, and after a considerable amount of discussion, the following resolution was unanimously agreed to:—"That this Committee strongly disapprove of the action of the City Council in appropriating £5000 of the surplus gas funds for statute labour purposes in George Square, instead of to the legitimate purpose of reducing the price of gas to the consumers, and that the office-bearers be instructed to communicate with the Committees of other wards with a view to the matter being further ventilated." The agitation thus commenced, coupled with the remonstrance from one of the most influential Ward Committees in the city, may, in course of time, have some influence on the Corporation Gas Commissioners.

So far as Dumbarton is concerned, it is said that perhaps one of the most noteworthy features of the present day is the rapidity with which gas is supplanting coal in the houses of the wealthy and well-to-do inhabitants of that town. Indeed, gas fires, gas ranges for cooking, gas stoves, &c., are all the rage in Dumbarton at present; and so great has the use of these become, that the quantity of gas consumed in the burgh has increased by at least 10 or 15 per cent. In one large house in the burgh, coal has all but been expelled; in many others, gas fires are taking the place of coal fires at a rapid rate, and in a sweeping manner, whilst for cooking purposes, heating baths, &c., gas is becoming a universal favourite.

Progress in street lighting is showing itself at Motherwell, the Police Commissioners of that burgh having at their last monthly meeting resolved that in future, during the lighting season, the street-lamps be all lighted on Saturday nights, irrespective of the moonlight, and that the period every month during which the lamps are not lighted on account of the full moon be shortened by two nights.

Mr. W. H. Preece, the Engineer to the Postal Telegraphs Department, came to Glasgow to-day for the purpose of inspecting the arrangements for lighting up the sorting-room and telegraph instrument-room in the local post office by the electric light. It is reported that the contract for doing the work for one year by Messrs. R. E. Crompton and Co., London, is practically as good as closed. I do not know what the terms of the contract are to be, but it would be worth while to learn whether or not the work can be done on the new system at the cost of gas. Gramme machines and Crompton's lamps have been used in the experiments.

The pig iron market has fluctuated somewhat this week, and the closing price yesterday was 1s. per ton under last week's closing quotations.

Very little change has taken place during the week in the Scotch coal trade. Prices in some districts are decidedly firm.

CURRENT SALES OF GAS PRODUCTS.

A Manchester correspondent, writing on Saturday, said: "Gas products continue firm. Some manufactured tar products are weaker, though pitch is in slightly increased demand." The following are prices realized in actual sales last week:—

Tar.—40s. for town contracts. The price of tar is at present high in proportion to the value of tar products generally.
Ammoniacal liquor (sp. gr. 1·035) commands 20s. to 24s. per ton.
Ammonia sulphate, white, £19 10s. per ton; grey, £18 10s. to £18 12s. per ton.
Ammonia muriate (sal ammoniac), £44 to £45 per ton; white, £31 to £36 per ton; grey, ordinary, £30 per ton.
Sulphuric acid (brown vitriol), £2 18s. to £2 19s. per ton (firm).
Muriatic acid, £1 5s. to £1 10s. per ton.

THE EXAMINATIONS IN "GAS MANUFACTURE."

In reference to the notice published last week of the examinations to be held next year under the auspices of the City and Guilds of London Institute for the Advancement of Technical Education, we have been asked to give an idea of the kind of questions put to candidates; and we cannot do better than re-produce the examination paper set for the three grades in this year's competition, three hours being allowed for the preparation of the replies in each case. The questions were as follows:—

Elementary.—1. What are the most important considerations to be kept in view in selecting a site for the manufacture and distribution of gas? 2. Describe the best settings of retorts for a minimum daily supply of 15,000 feet of gas? 3. Describe the necessary storeage to be provided for, say, the daily supply of 15,000 feet of gas? 4. Describe the settings best adapted for, say, a minimum daily supply of 150,000 feet of gas? 5. What are the advantages in large works to be derived from the use of Great Central Company's through and through retorts? 6. What quantity of gas ought a retort of a given size to produce during its lifetime? 7. May stopped pipes be prevented, and how? 8. What are the advantages derived from the use of exhausters? 9. State the most improved plan of securing a level gauge on the retorts, and avoiding the possibility of drawing in atmospheric air? 10. Give a general description of a dry gas-meter, and the principles of its measurement. 11. Give a general description of a wet gas-meter, its construction, and the principles upon which its measurement is based.

Advanced.—1. In estimating the value of coals for the production of illuminating gas, what are the considerations to be kept in view? 2. Is it necessary and always desirable that the storeage of gas should be where it is made? In some cases, is it desirable to have a gasholder or holders in the centre of the supply, or near it? Give reasons. 3. Describe the extent of storeage which ought to be provided for a daily consumption of, say, 300,000 feet of gas. 4. Describe the most approved shape and size of gasholders and tanks, having regard to economy and certainty of action, for a maximum daily supply for, say, 5 million feet of gas, having regard to cost of construction of gasholders, frames, and tanks. 5. What are the advantages to be derived from the use of clay and iron retorts in combination, the clay retorts being in two arches surrounding the furnace, the iron retorts being in another arch, as introduced by the Great Central Company? 6. What are the advantages in using red-hot fuel, and clinkering the bars from below (as used by the Great Central Company), instead of at the furnace doors? 7. Describe the after-process to be carried out in the purification of gas, having regard to purity, illuminating power, and the value of the residual products—tar and ammonia. 8. Can salts or acids be employed in freeing gas from ammonia, especially metallic salts, such as the residuum of certain chemical manufactories, and what are they? 9. In the arrangement of gas-mains in crowded streets, is it desirable to have a main on each side of the street, in the carriage way, or are there advantages in having one large main in the centre of the carriage way, and with small subsidiary mains on each side in the footways, to which the services are connected, as first applied by the Great Central Company? Give reasons for your answer. 10. Is the unaccounted-for gas not due to a large extent to inaccurate registration, stealage, and under-estimating the consumption of gas by the public lamps, and over-estimating the production of gas at the works? Give reasons for your answer. 11. What are the causes that lead to the production of naphthaline? 12. Describe the simplest and most effectual method of clearing mains and services of naphthaline?

Honours.—1. In manufacturing gas from coal, may not the destructive distillation be carried on too far? and quantity be obtained at the cost of illuminating power and the production of deleterious gases? Give your reasons. 2. Does not carbonic oxide gas lessen the illuminating power of other light-giving gases to a greater extent than its own bulk? State facts within your own knowledge. 3. When bisulphide of carbon is formed, why is it difficult or commercially impossible to remove it in the after stages of purification? State facts within your own knowledge. 4. State the extent to which gas is deteriorated by the admixture of atmospheric air? 5. How much is it lowered, say, by the admixture of 1 per cent? 6. What pressure of gas is required to overcome the necessary friction in its passage through well-arranged meters and fittings, to afford a good supply of gas to the consumers? 7. A pressure of gas beyond that which is necessary to give a good light, involves a loss to both producer and consumer; why? 8. To what extent is the loss of gas which arises from the action of the forces, exosmose and endosmose, modified by varying pressures? And do these forces act with equal power when the gas in the mains is at rest, as when the gas is in motion? Give illustrations. 9. Do various kinds of coal yield gases differing in their penetrating power; that is, supposing that one description of coal produces gas equal to 16 candles, and another description of coal yields 24 candles, the photometrical observation being made with the lights 100 inches apart, when the experiment is made with lights fixed 200 inches apart, does this relative proportion hold good? Give result of experiments. 10. The leakage of gas has been variously taken at from 5 to 20 per cent. What becomes of it? 11. What is the impure gas that is often found in gas supplied to the public, which, more especially, acts upon the brass in meters, and corrodes and stiffens the stopcocks in fittings? 12. What is that impure gas which is generally, and, in many cases, to a most injurious extent, contained in the gas supplied to the public, and which is not detected by the acetate of lead test, but which produces a choky and deleterious effect upon the atmosphere in which it is consumed, tarnishing gildings, and destroying the bindings of books? 13. To what extent can machinery be employed to advantage in lieu of manual labour, more especially in drawing and charging retorts? Can you give any results of the working of Foulis's, West's, or any other system?

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There has been a lull in the demand for the better classes of round coal during the past week, owing to the extreme mildness of the weather, and although in the Manchester district the advances made at the commencement of the month are being maintained, less firmness seems to characterise the upward movement in other Lancashire districts. In the West Lancashire districts any further advance this month has not been general, and in many cases where colliery proprietors have put up their prices they are not disposed to lose orders by holding out for an advance upon last month's rates. The agitation which is now going on amongst the miners in Lancashire for an advance in wages seems to have excited some little apprehension with regard to the future amongst consumers of gas coal, as I hear of private inquiries with regard to further supplies having recently been made from several quarters. In manufacturing classes of fuel there is very little material change except so far as slack is concerned. The advance in the price of this class of fuel, which was made in the Manchester district at the commencement of the month, seems to have driven some of the consumers of engine fuel on to burgy; whilst in other districts the increased production of slack has caused a slightly easier tone in this description of fuel, and at some of the collieries concessions are being made to secure orders rather than stock. The average prices at the pit's mouth may be given about as under:—Best Wigan Arley, 9s. to 9s. 6d.; common sorts, 6s. 6d. to 7s. 6d.; Pemberton four-feet, 7s. to 7s. 6d.; common Wigan mines, 6s. to 6s. 6d.; steam and forge coal, 5s. 3d. to 5s. 9d.; burgy, 4s. to 4s. 6d.; and good ordinary slack, 2s. 9d. to 3s. 3d. per ton.

In the shipping trade a moderate amount of business is being done, but sellers find it difficult to obtain any material advance in prices.

Coke continues in fair demand at about 9s. to 12s. per ton at the ovens.

The miners in the Wigan, Oldham, and Ashton districts are now agitating for an advance in wages, and in the Little Hulton district, near Bolton, the men at several of the pits are out on strike.

The iron trade is very dull, and there has been extremely little business doing during the past week. Local makers of pig iron are firm at their full rates of 46s. 6d. to 47s. 6d., less 2½ for delivery equal to Manchester; but amongst holders of outside brands there is an easier tone, and more disposition to sell for long forward delivery, iron in some cases being now offered at present rates over the first six months of next year. For finished iron there is very little demand, and prices all through are low. Local bars do not fetch more than about £5 15s. for delivery equal to Manchester, cast-iron pipes are offered at £4 per ton and under, and for wrought-iron pipes extreme discounts are now being quoted.

NOTES FROM MONMOUTHSHIRE AND SOUTH WALES.

(FROM OUR OWN CORRESPONDENT.)

The tone of the coal market continues firm, although the demand is not so active as it was a month ago. A pretty fair quantity of tonnage was despatched during the past week, and collieries were busily employed. In some cases there is still difficulty in getting ready tonnage stemmed. Prices have not undergone any material change, but sellers are able to sustain the rise previously noted, and this in the very face of the fact that the inquiries from some of the Mediterranean markets are not pressing just at the moment. There was an improvement in the quantity of coal shipped during the last week, as compared with the previous week, to the amount of 741 tons. The actual clearances at Newport last week reveal a very good total, and also show that the local collieries have been well employed. The firmness in coal prices is well maintained, and it has been in most cases with difficulty that buyers have been able to get their requirements satisfied, unless at an advance. In certain cases sellers are not anxious to add anything further to their stems, although offered an advantage in price.

The iron-works are in no way less busy than previously reported. Tin-plates are still in a very languid state. In the quantity of coal shipped at Swansea last week there was an improvement over the previous week to the amount of 4319 tons. The steam coal clearances also showed an improvement as compared with those of the previous week; at the same time they were considerably below the average. With a better supply of tonnage a steady weekly increase would be shown. So scarce has tonnage been of late at Swansea that several shippers have been obliged to transfer their orders to Cardiff and Newport for execution. Steel rails show a decided improvement, makers being unwilling to quote for forward orders, at all events not until some of the contracts now in the market have been allotted. Tin-plates show no material advance, the same low prices as those previously reported still ruling in Liverpool and elsewhere.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The steady improvement reported in the coal trade in this district continues, and orders are more plentiful with nearly all the colliery proprietors. The increase in business, first apparent in the Cannock Chase neighbourhood, has extended to the various other localities, and the hands are now employed more time than has been known for a considerable period. Prices for all kinds of thick coal are very firm, and it is considered probable that a further increase in rates will be made by leading firms. Ironmaking fuel is also more needed, and there is a fair existing demand for gas coals of good quality. Cokes are selling at much the same rates, and, though the call is good, prices, owing to an abundant supply, are unchanged.

The iron trade is, on the whole, progressive. Most manufacturers of the finished material are well supplied with orders, and, in fact, hold enough to keep their mills well employed for several weeks to come. The attendance on 'Change at both Wolverhampton and Birmingham during the past week was good, and fair lines were booked. The list houses are very firm to standard quotations of £7 10s. for marked bars, £6 10s. being the ruling rate for unmarked qualities. At £9 orders were fairly numerous for girder and boiler plates. Strip and hoop iron is being sold at £6 10s. to £7. For galvanizers sheets there exists a fair demand. Prices are returned at £7 10s. to £7 15s. for singles, owing to the existing differences between masters and the operatives. Nail rod has a slow sale; nevertheless orders for the foreign market are more numerous than they have been for several weeks. The pig iron trade is, on the whole, more healthy, and though there is no increase of furnaces reported for the past two weeks, stocks are being considerably reduced. Best qualities are in greatest demand, and several contracts were reported to have been placed with some of the largest smelters. Cinder pigs are scarcely so much called for, but for all classes of foundry iron there is an improving market. Cable bars are selling but slowly, and the call for hematites is not great, a few steel makers only being in the market. Heavy iron-founders are steadily employed, and report an improvement in the foreign trade. Makers of tubes state that business is slightly improving.

YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The most important feature connected with the coal trade of this country during the past week has been the consideration of the Employers Liability Act, and the attempt to come to some understanding respecting its working. A large meeting of West Yorkshire miners has been held at Castleford, at which Messrs. Pickard and Parrott, the miners secretaries, advise the men not to contract themselves out of the Act. Similar advice has been given by Mr. Frith, the South Yorkshire miners agent, and at a meeting held at Wombwell it was resolved not to interfere with the question until after the National Conference to be held in January next.

The business in steam coal continues dull, although the exports from Hull, Grimsby, and Goole are favoured by the open weather, some of the northern ports not having yet closed. The week has been a memorable one, owing to the rapidity with which the shares in the new Hull and Barnsley Railway and Docks have been taken up. Although the line does not reach Barnsley, and some of the pits are not approached in a direct form by it, still it is believed it will act as a great boon to the South Yorkshire steam collieries, particularly during the winter months, when the hard coal has to be stacked on the pit's bank in order to get house coal.

Throughout both districts other kinds of fuel are not over active. Manufactured coal is easy to procure, and at some places the coke trade is only moderate. The chief demand for the South Yorkshire coke is that of smelters in North Lincolnshire, where trade continues pretty active.

The steel trade, taken as a whole, presents a healthy and active aspect. The works at Penistone are fully employed, and, it is understood, will be until the Christmas holidays set in. Pig iron is still largely produced at the furnaces at West Ardsley, Milton, Elsecar, Thorncliffe, Parkgate, and other places, nearly the whole of which draw their supplies of ironstone from North Lincolnshire. The foundries, with few exceptions, are badly off for work.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas coal trade is as active as has been the case in any November and December over the past three or four years. The pits are working full time, and there are no stocks. As handy steamers have come out of the Baltic into the coasting trade, the supply of tonnage is ample. The shipments of gas coals were hardly so good last week as in the previous one; but the previous week's shipment of coals from the Tyne Dock was the largest on record—viz., 110,000 tons. As the larger portions of the gas coals placed on board steamers last week were to send coastwise, the home demand was fully met. There are not any reports of long contracts having been made. Most of the business which has been done has been for supplies not to exceed twelve months. Prices are unaltered. The transference of second-class gas coals into the house trade is stopped, as it has been found that the latter market cannot be forced beyond a certain point. The demand for Durham manufacturing coals and also for coke has not been so strong for a long time, coke being much required, not only for the Cleveland iron district, but also for the west coast and North Lincolnshire. Manufacturing coals are fully 6d. per ton higher than at the beginning of the month, and the general price of coke at the ovens for blast furnaces is 10s. to 10s. 6d. per ton. Contracts have been made for the higher qualities of coke for locomotive and other purposes, to be delivered over next year, at a slight advance in price. The business doing in steam coals is better than in the corresponding month of last year.

The sailing tonnage employed in coasting met the requirements of merchants and gas companies last week, and freights to the Channel, Eastern Counties, the North of France, Ireland, and Scotland did not advance. At the same time there was no urgency on the part of the colliery offices in the engagement of more sailing vessels or steamers to load gas coals. Rates were unaltered.

The iron trade of the North of England is in a pretty sound condition. The finished iron trade is still improving, and manufacturers of plates and angles are nearly fully booked for four or five months to come. The iron-founders continue to do better. It is believed at Middlesbrough that a brighter time is dawning once more for the engineering and ironfounding branches there. The foundries on the Tyne are specially busy in the manufacture of heavy castings.

There is nothing special doing in the fire-brick or fire-clay trade generally. As most of the second-class factories have transacted a somewhat unprofitable trade this year, they are careful not to accumulate stocks over the winter. The chemical market improved last week. The demand for soda was very brisk, and there was an advance in prices for soda, ash, and bleaching powder. The demand for cement is quiet, and the lead trade is dull. Only a very ordinary business is transacted in woods of all kinds, and there is no advance in prices.

At the Glasgow Philosophical Society's recent exhibition, a first-class certificate (the highest award) was received by the Waste Water Meter Company, Limited, of Liverpool, for their exhibit of Deacon's waste water meter.

M. Aube, says a foreign contemporary, is attracting much attention in France by his new process of converting iron into steel, and producing an illuminating gas by the process. The iron is heated to 900° C. in a retort with coke or charcoal. Fatty matters are then injected, and dry steam forced over the heated mass. Thus steel of high quality is formed, and carburetted hydrogen gas evolved.

The Newbury Corporation New Gas-Works.—These works, which have been carried out under the superintendence of Mr. J. G. O'Farrell, have so far approached completion as to allow of the manufacture of gas at them during the past week.

Dinner to the Employés in the Nottingham Corporation Water Department.—Mr. Thomas Hawksley, C.E., who has recently terminated his long connection with the late Nottingham Water-Works Company, extending over 50 years, invited the whole of the *employés* of the Corporation Water Department to dinner on Friday and Saturday, the 3rd and 4th inst. About 35 persons sat down each evening to a substantial dinner. Mr. Hawksley was unable to be present, but sent a letter to be read on the occasion. The chair was taken by his son, Mr. Charles Hawksley, and the vice-chair was occupied by the late Resident Engineer, Mr. Henry Rofe. After dinner the Chairman gave the usual loyal toasts. The Vice-Chairman then proposed the toast of the evening, "The health of Mr. Thomas Hawksley," which was most enthusiastically received. Mr. Moore proposed "The health of Mr. Charles Hawksley, the Chairman," who replied, and proposed the toast of "Success and Prosperity to the Corporation Water-Works," which was acknowledged by Mr. Moore and Mr. Beardsley. Mr. Moore then, in proposing "The health of Mr. Rofe," requested his acceptance of a testimonial—a very handsome clock, with a suitable inscription—which had been subscribed for by the *employés* as a slight mark of their high esteem and great regret at his ceasing his connection with them. Mr. Rofe suitably replied. A most enjoyable evening was spent on each occasion.

CASTLE CARY GAS AND COKE COMPANY.—This Company was registered on the 7th inst. with unlimited liability, having been previously constituted by deed of settlement, and subsequently incorporated as an unlimited company under the Joint Stock Companies Act, 1856.

ANTWERP WATER-WORKS COMPANY, LIMITED.—A Company under this title was registered on the 1st inst., with a capital of £300,000, in £20 shares, for the acquisition of a concession for the exclusive right of the distribution and sale of water in Antwerp for 50 years after the completion of the necessary works, for the sum of £280,000; and also the water-works now in course of construction.

THE LANCASTER CORPORATION WATER-WORKS ARBITRATION.—The award in this case, the proceedings in which were reported in the last and previous numbers of the JOURNAL, has been given by Mr. W. C. Gully, Q.C., the Arbitrator, who has estimated at £3500 the amount due to Mr. H. Garnett, from the Lancaster Corporation, as compensation for the water taken by them from his land under their Act of 1876. Mr. Garnett has also been allowed his costs of the application to the High Court of Justice, the Corporation to bear their own costs.

THE WATER SUPPLY OF CARDIFF.—Some time since the subject of obtaining an additional supply of water for Cardiff and the neighbourhood engaged the serious attention of the local authorities. A proposition has now been made to furnish such supply from Aber Brook, situated a few miles from Cardiff. It is stated that at a very moderate cost an embankment could be thrown across the Aber Valley, and thus impound about 100 million gallons of water; the reservoir being about nine miles north of Cardiff, and situated at such an elevation as to allow the water to gravitate in pipes to Cardiff and Llandaff. The water in the Aber Brook, when only half bank high, runs at the rate of 15 million gallons in the 24 hours, and one of its characteristic features is that in times of flood it flows down in a comparatively clear state. The scheme, which is by Mr. G. A. Lundie, M.Inst.C.E., of Cardiff, is estimated to cost £78,250, against which would have to be placed the sum of £1140 per annum now paid for pumping, which would be saved if the proposed works were carried out, and a yearly revenue of £860—together, £2000. This capitalized at 4 per cent.—£50,000—and deducted from the estimated cost of the scheme, would leave the net cost only £28,000. The new water supply would be taken from pure sources, and be soft in character.

THE BARTON LOCAL BOARD AND THE IMPROVEMENT BILL OF THE SALFORD CORPORATION.—A special meeting of the Eccles and Barton Local Board was held on Monday, the 6th inst.—Mr. H. Leigh in the chair—for the purpose of taking steps in opposition to certain clauses in the Bill which it is the intention of the Salford Corporation to introduce into Parliament in the forthcoming session. The clauses to which the Board specially object are to give the Corporation the power to supply the electric light to all districts which they now supply with gas, the Barton Local Board being one of those districts. The Clerk (Mr. G. Trenbath) read a lengthy correspondence which had taken place between himself and the Salford Corporation. One letter which he had received from the Town Clerk of Salford (Mr. C. Moorhouse) stated that the Corporation had no desire to have any contention on the matter of the electric light, and if the Local Board preferred that they and the inhabitants of their district should not be supplied with it by the Corporation, they (the Corporation) were perfectly indifferent about the matter, and would confine their application to their own borough, and he (the Town Clerk) had, by a meeting of the General Purposes Committee, been instructed to alter the wording of the Bill accordingly. Mr. Trenbath thought the Board ought to take steps to obtain *locus standi* in Parliament, and the consent of the ratepayers to oppose the Bill. On the motion of Mr. R. Spary, seconded by Mr. A. Black, it was resolved—"That this Board hereby consents to the opposition in the next session of Parliament to such clauses or provisions of the Improvement Bill of the Salford Corporation as relate to the supply within the limits of this district of gas, light, and heat produced by electricity."

BLACKBURN CORPORATION GAS SUPPLY.—At the meeting of the Blackburn Town Council on the 2nd inst.—Alderman Hutchinson in the chair—the minutes of the Gas Committee were presented, and, in moving their confirmation, Mr. Beads said he thought the Committee might fairly congratulate themselves on the success of the late gas exhibition. The inhabitants of the town had been shown how they might apply gas especially to cooking purposes, on very economical principles; but he would suggest that, having shown the people how to increase the consumption of gas, the Council ought to give it to them at a cheaper rate. The Treasurer had in hand £9500, and he believed the profits of the gas-works this year would not be less than £4000. He knew that two years hence they would have to set aside a redemption-fund, probably amounting to £7000 per year; but at that time he took it the Council would have a reserve-fund, which they were not required to hold by their Act, of £15,000. He thought, therefore, they might very safely reduce the price of gas 2d. per 1000 feet, in anticipation of the increased consumption, with the reserve-fund they had in hand towards paying for the redemption of the works. The proposition he intended to submit to the next Committee meeting was that after the 1st of January next a reduction of 2d. per 1000 feet be made to those consumers who pay their gas bills before the sixth day of the second month of the quarter. He believed that this would effect an immense economy in the collection of the accounts. Mr. Abram said one reason why the Committee had not been able to cheapen gas before was that they were saddled by the Poor Law authorities with very heavy taxation. No gas-works in England, for a town of the same size as Blackburn, were taxed to anything like the same extent. Although they had been heavily taxed before, the assessment of the works had been very recently raised £3000. He was ready to support Mr. Beads in his proposal to reduce the price of gas even to the extent of 3d. per 1000 feet—not merely to the rich, who paid their bills soon, but to the poor, who could not do so. Mr. Beads remarked that there were 15,000 or 16,000 gas consumers, and the delay in payment applied equally to all classes. The Chairman said he did not think the Council should make any reduction until they were in a better position, and saw what would become of the electric light. They had a large capital invested, and must get it back. The minutes were confirmed.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

5040.—DEVINE, H., Manchester, "Improvements in the construction of gas regulators." Dec. 3, 1880.

5064.—THORP, T., Whitefield, and TASKER, R., Prestwich, Lancs, "An improved apparatus for regulating the flow of gas to burners." Dec. 4, 1880.

5090.—FOULIS, W., Glasgow, "Improvements in gas-engines." Dec. 7, 1880.

5099.—STEAD, W., Northallerton, Yorks, "Improvements in meters or apparatus for measuring or ascertaining the flow of liquids or gases through pipes or conduits, which improvements are also applicable to motive power engines and pumps." Dec. 7, 1880.

5100.—BARLOW, H., New York, U.S.A., "An improved apparatus for regulating the pressure, and economizing the consumption of gas in its passage to the burners." Dec. 7, 1880.

5101.—RICHARDSON, W. E., Birmingham, "Improvements in gas-engines, and in apparatus connected therewith for the supply of gas to them." Dec. 7, 1880.

5102.—TALABD, N., Paris, "Improvements in pipe-joints." Dec. 7, 1880.

5116.—SCHLOESSER, R., Manchester, "Improvements in the construction of water-meters." A communication. Dec. 8, 1880.

5121.—DEFRIES, C., Houndsditch, London, "Improvements in gas-burners." Dec. 8, 1880.

5122.—COWAN, W., Edinburgh, "Improvements in gas-governors." Dec. 8, 1880.

5125.—MAYS, J. A., Great Winchester Street, London, "Improvements in valves for regulating or controlling the supply and discharge of water or other fluids." Dec. 8, 1880.

5130.—LIVESEY, J., Westminster, "Improvements in gas motor engines." A communication. Dec. 8, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2338.—WILSON, J. G., Manchester, "An improved construction of condensing steam engine and boiler with automatic air or gas and water supply, also applicable to other steam generators or boilers." A communication. June 9, 1880.

2404.—BURGESS, C., Birmingham, "A new or improved water tap for the prevention of waste, or the possibility of freezing." June 14, 1880.

2458.—BEST, G., March, Cambridgeshire, "Improved mechanical apparatus for purifying and softening water by removing therefrom the lime and other hardening matters held in solution." June 17, 1880.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

4323.—PIEPER, C., "Improvements in the apparatuses for the purification of coal gas." Nov. 19, 1877.

4398.—SCHÜLKE, J., "Improvements in dry gas-meters." Nov. 22, 1877.

4420.—KROMSCHRÖDER, J. F. G., "Improvements in means or apparatus for carburetting and purifying coal gas." Nov. 23, 1877.

4452.—WISE, W. L., "Improvements in lighting apparatus." Nov. 26, 1877.

4479.—AUBE, P., "Improvements in the manufacture of gas and in apparatus used in its production." Nov. 28, 1877.

4536.—WIRTH, F., "Improvements in purifying water." Dec. 1, 1877.

4576.—HILTON, M., "Improvements in the manufacture of gas." Dec. 3, 1877.

4591.—PLATT, J., "An improved automatic gas-stove for heating irons." Dec. 4, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

3868.—PARKER, J. F., and WADE, A., "Improvements in the process of and apparatus for the manufacture of coke and illuminating gas; part of which improvements may also be applied to the smelting of iron ores and other ores." Nov. 26, 1873.

3910.—BELL, J., jun., and R., "Improvements in utilizing the waste heat of materials employed in retorts, and in the apparatus or means employed therefor." Nov. 29, 1873.

RETURN to the Metropolitan Board of Works of the testings made at the gas-testing stations during the week ending Dec. 8, 1880.

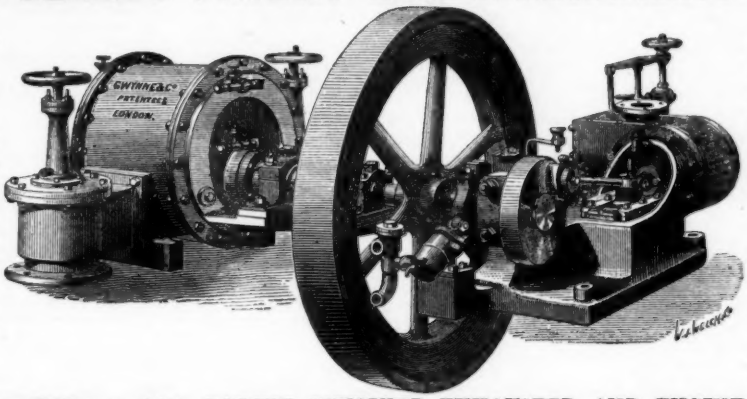
Company.	District.	Illuminating Power. (In Standard Sperm Candles.)			Sulphur. (Grains in 100 Cubic Feet of Gas.)			Ammonia. (Grains in 100 Cubic Feet of Gas.)			Sulphuretted Hydrogen.	Pressure.
		Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.		
The Gaslight and Coke Company	Notting Hill	18·0	16·8	17·3	11·6	8·6	10·3	0·2	0·0	0·1	None.	In excess
	Camden Town	17·5	16·6	17·0	18·0	15·5	16·7	0·0	0·0	0·0	"	"
	Dalston	17·1	16·8	16·9	11·8	9·0	10·5	0·2	0·0	0·0	"	"
	Bow	17·3	16·6	16·9	14·6	10·5	13·3	0·3	0·1	0·2	"	"
	Chelsea	17·0	16·3	16·6	18·3	14·0	16·3	0·5	0·0	0·3	"	"
	Kingsland Road	17·2	16·7	16·9	13·6	9·0	11·3	0·1	0·0	0·0	"	"
	Westminster (cannel gas)	21·3	21·0	21·1	19·6	13·8	15·8	0·2	0·0	0·0	"	"
South Metropolitan Gas Company	Peckham	16·9	16·4	16·7	13·8	8·9	11·4	0·4	0·0	0·2	"	"
Commercial Gas Company	Old Ford	17·9	16·7	17·1	19·8	12·2	15·4	0·5	0·2	0·3	"	"
	St. George-in-the-East	17·3	16·9	17·1	12·6	10·0	11·2	0·0	0·0	0·0	"	"

(Signed) T. W. KEATES, F.I.C., Consulting Chemist and Superintending Gas Examiner.

Note.—The standard illuminating power for common gas in the Metropolis is 16 sperm candles, and for cannel gas 20 sperm candles. Sulphur not to exceed 20 grains in the 100 cubic feet of gas at Bow station, and 25 grains at all other stations. Ammonia not to exceed 4 grains in the 100 cubic feet of gas. Sulphuretted hydrogen to be entirely absent. Pressure between sunset and midnight to be equal to a column of one inch of water; between midnight and sunset, six-tenths of an inch.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.

THE GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION, and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & Co., for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.



GWYNNE & CO.
Have made the largest and most perfect GAS-EXHAUSTING MACHINERY in the world, and have completed Exhausters to the extent of 14,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.

The Judges report on the COMBINED EXHAUSTER and STEAM-ENGINE exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

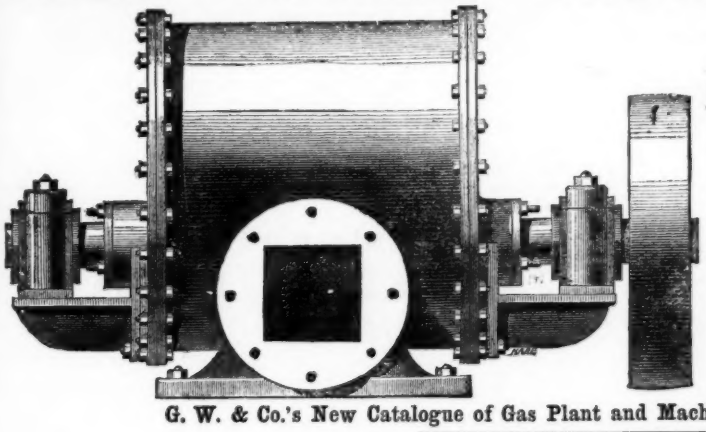
GWYNNE & CO.'S PATENT COMBINED EXHAUSTER AND ENGINE.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work i giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.
Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,



WITH OR WITHOUT
WROUGHT-IRON SPINDLES AND
ENGINES COMBINED.

GEORGE WALLER & CO.,
MAKERS OF
ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

PHŒNIX ENGINEERING WORKS:
HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of a Pamphlet, prepared for Gas Companies to distribute to Gas Consumers—"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

WANTED, by a Young Man (married), a Situation in a Gas-Works. Is the son of a Manager, and is a good Main and Service Layer. Can do any Fittings in the Retort-House; also can Fix and Read Indexes of Meters, and has had experience both at Lathe and Vice. Very steady.
Apply to the MANAGER, Gas-Works, Crayford, KENT.

WANTED.—The Advertiser, a Young Man, aged 39, married, is open for an Engagement as MANAGER and SECRETARY of a medium-sized Gas-Works, or SUB-MANAGER of a large Works. Has a thorough Knowledge of the Manufacture and Distribution of Gas in all its branches, having had sole management of Gas-Works for 16 years. Highest testimonials and references.
Address No. 678, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Newcastle-under- Lyme Gas Company, a good, efficient, and steady GAS-FITTER. General good character indispensable.
Applications and references to be sent to the undersigned.
W. WINSTANLEY, Engineer and Manager.

THE Town Commissioners of Bandon will receive APPLICATIONS from persons competent to discharge the duties of MANAGER and FITTER of their Gas-Works. Salary at the rate of £100 per annum, with residence, coal, and light.
Applications, accompanied with reference and testimonials, to be lodged with me, on or before Saturday, Jan. 1, 1881.
S. R. TRESILIAN, Clerk to the Commissioners.
Bandon, Dec. 9, 1880.

WANTED, at a Gas-Works making about 200 millions a year, in the immediate neighbourhood of London, an experienced GENERAL FOREMAN, who thoroughly understands the Carbonizing and Purifying Departments.
Applicants must not be under 30 nor over 45 years of age.
Address No. 704, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED at once, by the Directors of a Gas Company in Derbyshire, a WORKING MANAGER thoroughly acquainted with the whole routine of a Gas Undertaking. The Directors provide a residence, fuel, and gas, and the person appointed must devote the whole of his time to the duties. Assistance is provided for eight months in the year.
Applications, in own handwriting, enclosing not more than two original testimonials, and stating age and amount of wages expected, to be made to the undersigned, who does not bind himself to return testimonials.
CHARLES EDWIN JONES, Consulting Engineer.
Chesterfield.

TO PROFESSIONAL ENGINEERS.

THE Waste Water Meter Company, Limited, are prepared to receive APPLICATIONS for the Office of SECRETARY and GENERAL MANAGER (in Liverpool). Salary £250 per annum. Commission and liberty to take private practice after first year.
Apply, by letter (for form of application and particulars) to CHAIRMAN of the Waste Water Meter Company, Limited, 4, Cook Street, LIVERPOOL.

AMMONIA PLANT FOR SALE.

A COMPLETE Plant in thorough work- ing order, to make up to 1½ tons daily; or Saturator and Crystallizing Pans will be sold separately. Also Cornish and other Boilers, Tar Stills, Hydraulic Press, Iron Tanks, Tangye's Pumps, &c., for Sale, and Waterside Premises to be Let.
Apply to T. V. CLARKE, on the premises, Trundley Lane, Surrey Canal, DEPTFORD, S.E.
Mr. Clarke will contract for the Re-erection of the Tar and Ammonia Plant in any part of the country.

THE Chester United Gas Company have FOR SALE about 20 Tons of RETORT CARBON. Offers are requested, addressed to the undersigned.
FLETCHER W. STEVENSON, Engineer and Manager.

THE Gravesend and Milton Gas Com- pany have FOR SALE, Four 12 ft. square PURIFIERS, 4 ft. deep, with 12-in. Connections and eighteen 12-in. Donkin's VALVES, together with Lifting Apparatus, all in fair condition, and can be taken possession of immediately; also one 8-in. GOVERNOR, by Sugg, of Westminster.
For further particulars apply to the undersigned.
S. SOWOOD, Manager.

TAR FOR SALE.

THE Directors of the Dronfield Gaslight and Coke Company are prepared to receive TENDERS for the Purchase of the Surplus TAR produced at their Works for One year from Jan. 1, 1881.
Tenders, stating price per ton at the Works, or delivered in casks at Dronfield Railway Station, should be sent to the undersigned not later than the 1st prox.
The Directors do not bind themselves to accept the highest or any tender.
CHRISTOPHER THORPE, Secretary.
Chesterfield, Dec. 1, 1880.

OXIDE OF IRON.

I offer for Sale NATURAL OXIDE; suitable for Gas Purification Purposes.
Quality first-class, and perfectly free from adulteration.
Sold by guaranteed analysis, which shows a very high percentage of Peroxide of Iron.
Price very moderate.
Quotations for cargoes delivered at any port in the United Kingdom.
THOMAS STEWART,
MILFORD, Co. DONEGAL, IRELAND.

FOR SALE—A small Tar Works, situated within 50 miles of London. Plant includes Tar and Napetha Stills, Hydraulic Press, Tanks, Railway Tracks. Also LAMP-BLACK FACTORY, large Yard and Offices.
Address No. 703, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WIDNES GAS-WORKS.

THE Widnes Local Board have a set of Four PURIFIERS to DISPOSE of (two of them 9 ft. square, and two 12 ft. square), with 12 in. Inlet and Outlet Pipes, Wrought Covers, Centre Valve, and Overhead Lifting-Gear.
Particulars and conditions may be obtained from the undersigned.
Tenders, endorsed "Purifiers," to be sent in not later than Jan. 2, 1881.
The Board do not bind themselves to accept the highest or any tender.
HENRY ROBERTS, Engineer.
Gas-Works, Widnes, Dec. 7, 1880.

THE Gloucester Gas Company have the undermentioned APPARATUS for Sale :—
About 130 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.
Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
4-horse power Horizontal Steam-Engine.
Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.
Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.
Gasholder, Double Lift, capacity 240,000 feet.
One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.
Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

MALTA.

LIGHTING BY GAS VALLETTA, FLORIANA, MARSA, SENGLEA, COSPICUA, & VITTORISSA.

SEALED Tenders will be received at this Office until noon of Monday, June 3, 1881, for Lighting by Gas the Streets of Valletta, Floriana, Marsa, Senglea, Cospicua, and Vittorissa, for a period of Ten years, to date from May 15, 1882.
Tenders to be on the established printed form supplied by this Office.
The conditions of the contract and further particulars will be made known on application to this Office; and to the Office of the Crown Agents for the Colonies, Downing Street, London.
Each tender is to be accompanied with a deposit of £200, which sum is to be temporarily lodged with the Receiver-General, to be dealt with as stated hereunder; and no notice will be taken of any tender unless the due fulfilment of this condition be found endorsed thereon by that Officer.
The deposit thus made shall be forfeited in favour of Government should the party tendering, or the surety, fail to appear for the stipulation of the requisite contract in the event of the tender being accepted, within three days from the day of the notice given to him to that effect.
The deposits of the unsuccessful tenderers shall be returned to them immediately after notice will have been given to the party whose tender will have been accepted.
Any notarial fees will have to be paid by the Contractor.
The undersigned retains the power of accepting or rejecting all or any of the tenders received.
C. RAPINET,
Acting Auditor-General and
Director of Contracts.
Office of the Auditor-General and Director of Contracts, Valletta, Oct. 7, 1880.

CORPORATION OF LANCASTER—GAS AND WATER DEPARTMENT.

TO GASHOLDER MAKERS.

THE Gas and Water Committee are pre- pared to receive TENDERS for the Construction and Erection of a Single-lift GASHOLDER, 130 ft. diameter by 30 ft. 6 in. deep, at their Works, St. George's Quay, Lancaster.
Plans and specifications may be seen or copies obtained at my Office, here, on and after Thursday, the 9th inst.
Sealed tenders, endorsed "Tender for Gasholder," must be sent in, under cover, addressed to T. Swainson, Esq., Town Clerk, Lancaster, not later than Tuesday, the 28th inst.
The Committee do not bind themselves to accept the lowest or any tender.
WM. FLEMING, Manager.
Gas-Works, Lancaster, Dec. 1, 1880.

TO ENGINEERS, IRONFOUNDERS, &c.

TENDERS are required for the Con- struction and Erection of the Wrought-Iron ROOFS of a Retort-House and two Coal Stores, for the Sutton, Southcoates, and Drypool Gas Company, Hull.
Drawings and specifications may be seen at the Office of the Company, at the Gas-Works, Hull, and at the Office of the Engineer, Mr. Thomas Newbigging, C.E., 5, Norfolk Street, Manchester.
Copies of the specifications, bills of quantities, and form of tender may be obtained of the Engineer, on payment of two guineas, which will be returned on receipt of a *bona fide* tender.
Sealed tenders, endorsed "Roofs Contract No. 2," to be in the hands of the undersigned not later than Monday, the 20th inst.
The lowest or any tender not necessarily accepted.
By order of the Directors,
F. W. OLDFIELD, Manager.
Sutton, Southcoates, and Drypool Gas Company, Hull, Dec. 6, 1880.

THE BUENOS AYRES (NEW) GAS COMPANY, LIMITED.
INCORPORATED 1875.
SIX PER CENT. DEBENTURES.
NOTICE is hereby given to the DEBENTURE-HOLDERS of the Buenos Ayres (New) Gas Company, Limited, that the Half-Yearly COUPONS at the rate of 6 per cent. per annum, due on the 1st of January next, will be paid on and after that date, at the Company's Bankers, Messrs. Prescott, Cave, Buxton, Loder, and Co., Threadneedle Street, London. Coupons must be left at the Bank three clear days for examination.
By order,
E. W. LAYTON, Secretary.
1, East India Avenue, Leadenhall Street, E.C.

TO the Shareholders of the Buenos Ayres (New) Gas Company, Limited—Incorporated 1875.—NOTICE is hereby given that the Share Books of the Company will be closed from the 1st to the 15th of January, 1881 (both days inclusive), preparatory to the declaration of a dividend.
By order,
E. W. LAYTON, Secretary.
1, East India Avenue, Leadenhall Street, E.C.

TENDER FOR TAR AND LIQUOR.

THE Directors of the Grantham Gas and Coke Company are prepared to receive TENDERS for the Purchase of their AMMONIACAL LIQUOR and Surplus TAR, for One, Two, or Three years, from Jan. 1, 1881. The quantity of coal carbonized in Twelve months is about 4000 tons.
Tenders to be sent to the undersigned, not later than the 20th of December inst., endorsed "Tender for Tar, &c."
The Directors do not bind themselves to accept the lowest or any tender.
Any further information may be obtained on application to Mr. Barratt, Engineer and Manager.
Gas-Works, Grantham, Dec. 4, 1880.

THE Hindley Local Board are prepared to receive OFFERS for One GASHOLDER, 50 ft. by 20 ft., with Six Pillars, Counterbalance-weights and Chains to each, wrought-iron Lattice Girders complete, with 8-in. Inlet and Outlet Connections; One Walker's Patent 8-in. Valve on outlet; One cast-iron Syphon Pump on inlet; 226 ft. of 8-in. Gas-Main Pipes, socket jointed. The whole of the best materials, by D. Howard and Son, West Bromwich; in use only six years.
Can be seen at Platt Bridge, Hindley.
Communications to be made to the undersigned.
By order,
STEPHEN HOLT, Clerk to the Board.
Offices, Cross Street, Hindley, Nov. 11, 1880.

TO MANUFACTURERS, INVENTORS, AND PATENTEES.

THE Trustees of the "Young" Chair of Technical Chemistry, Anderson's College, Glasgow, have reserved in their New Building Five Private Laboratories for the especial use of persons who require isolation and privacy.
The Laboratories are under the direction of PROFESSOR MILLS, F.R.S., to whom application should be made.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
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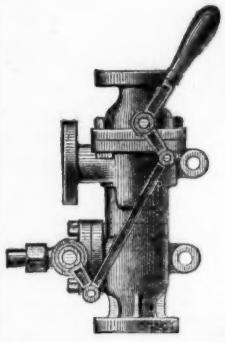
For Gas, Steam, and Water; also Black Galvanized and Enamelled.

WORKS:	*Quotations and Pamphlet on application to*	LIVERPOOL OFFICE
West Bromwich.	97, CANNON STREET, LONDON, E.C.	34, Moorfields.



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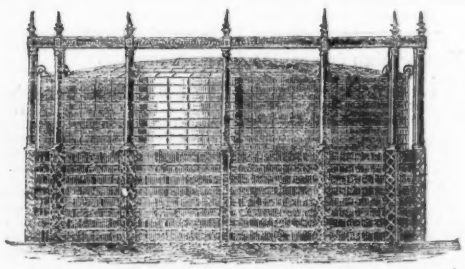

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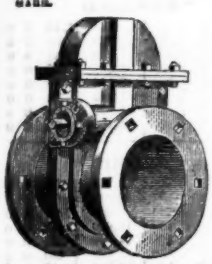

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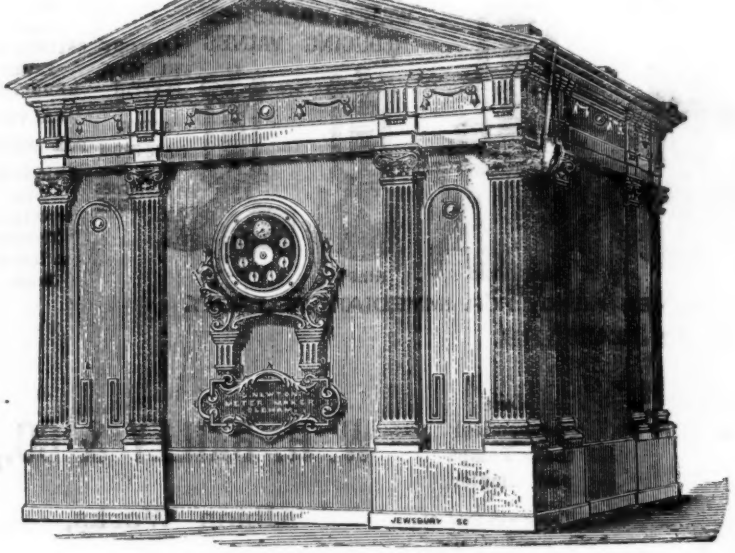

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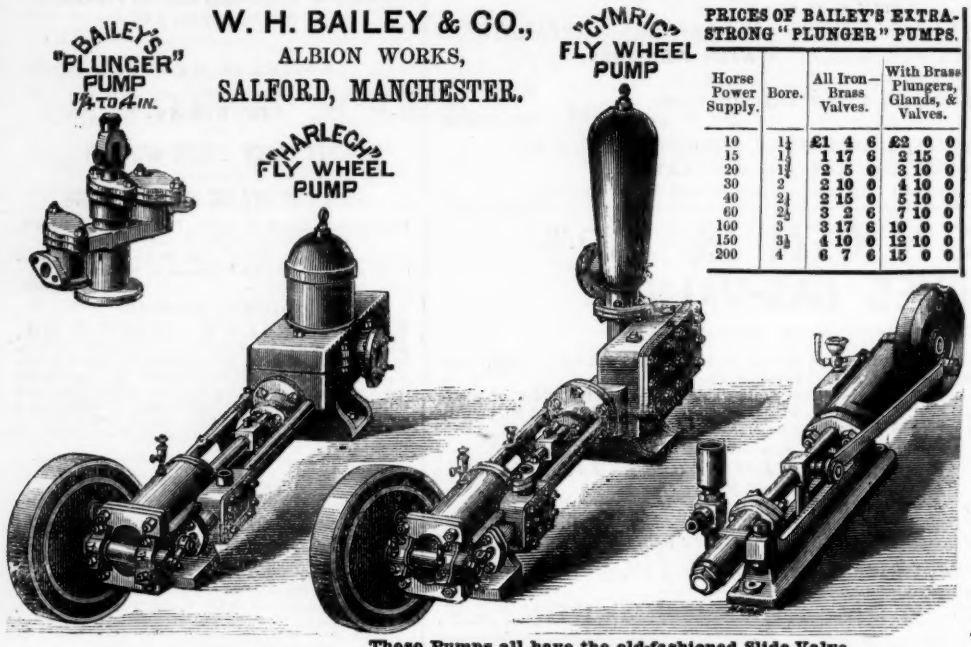

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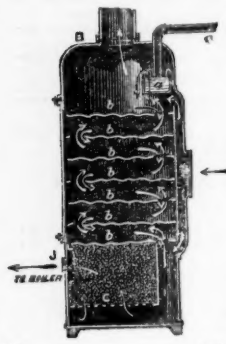

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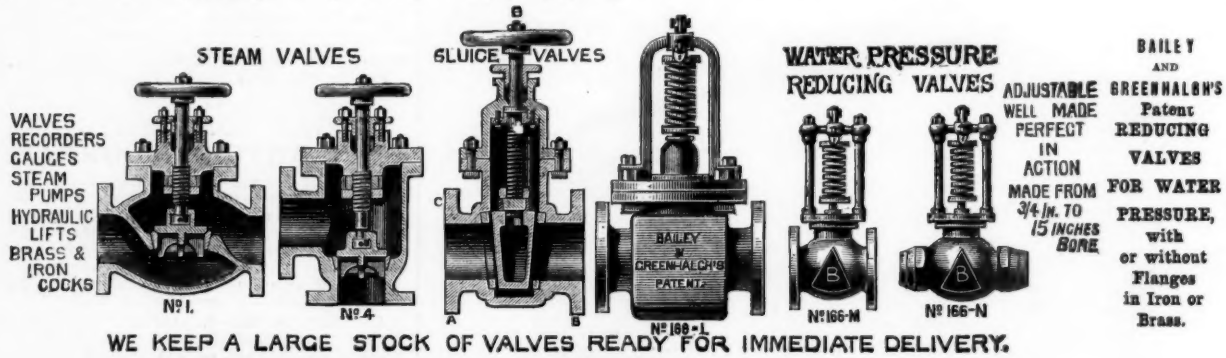

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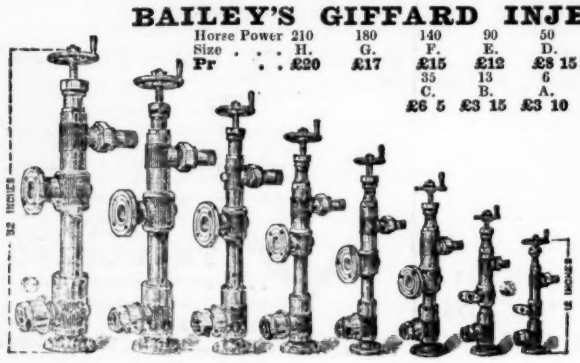

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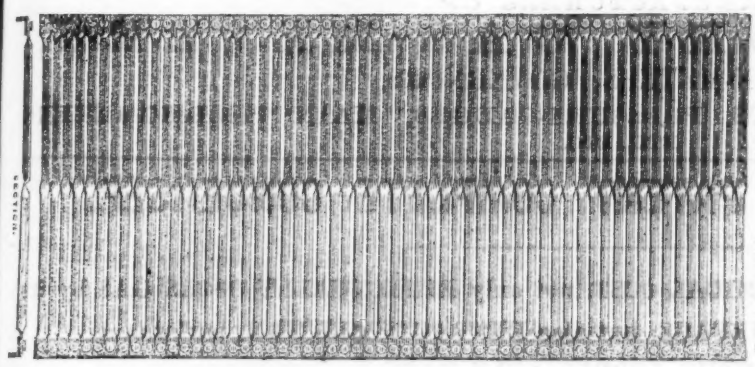

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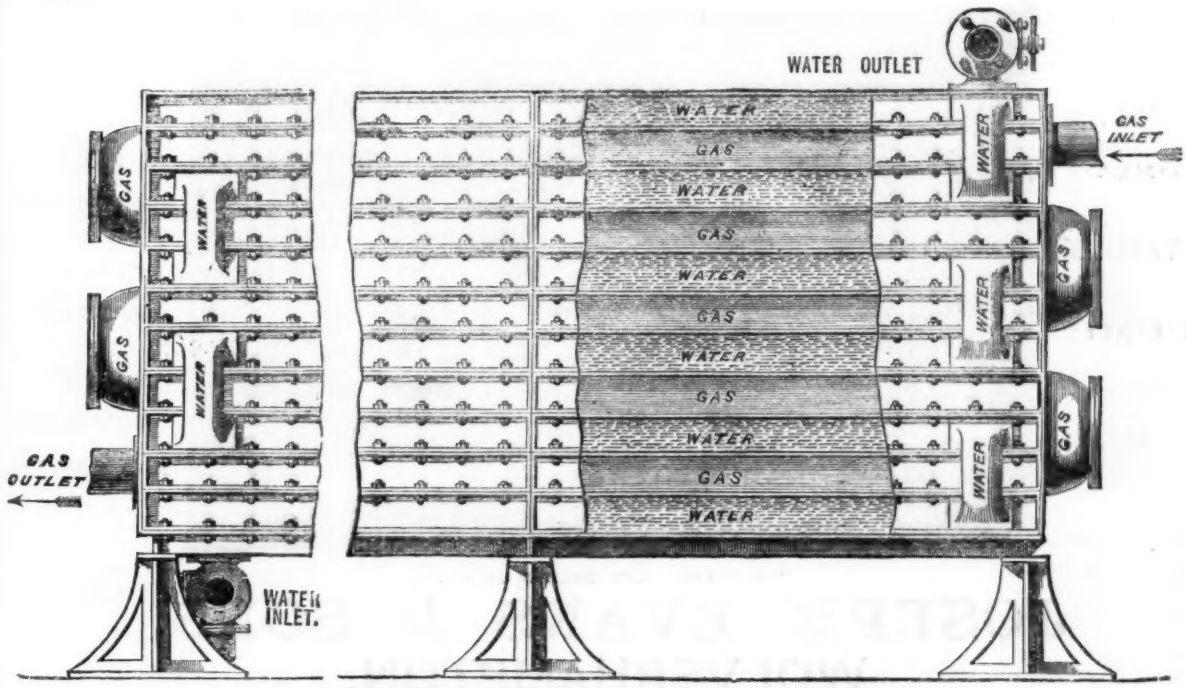

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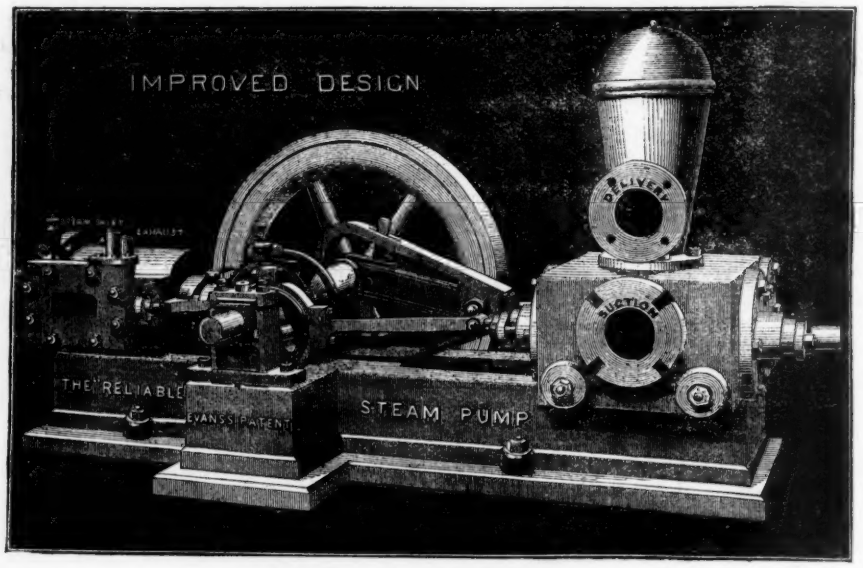

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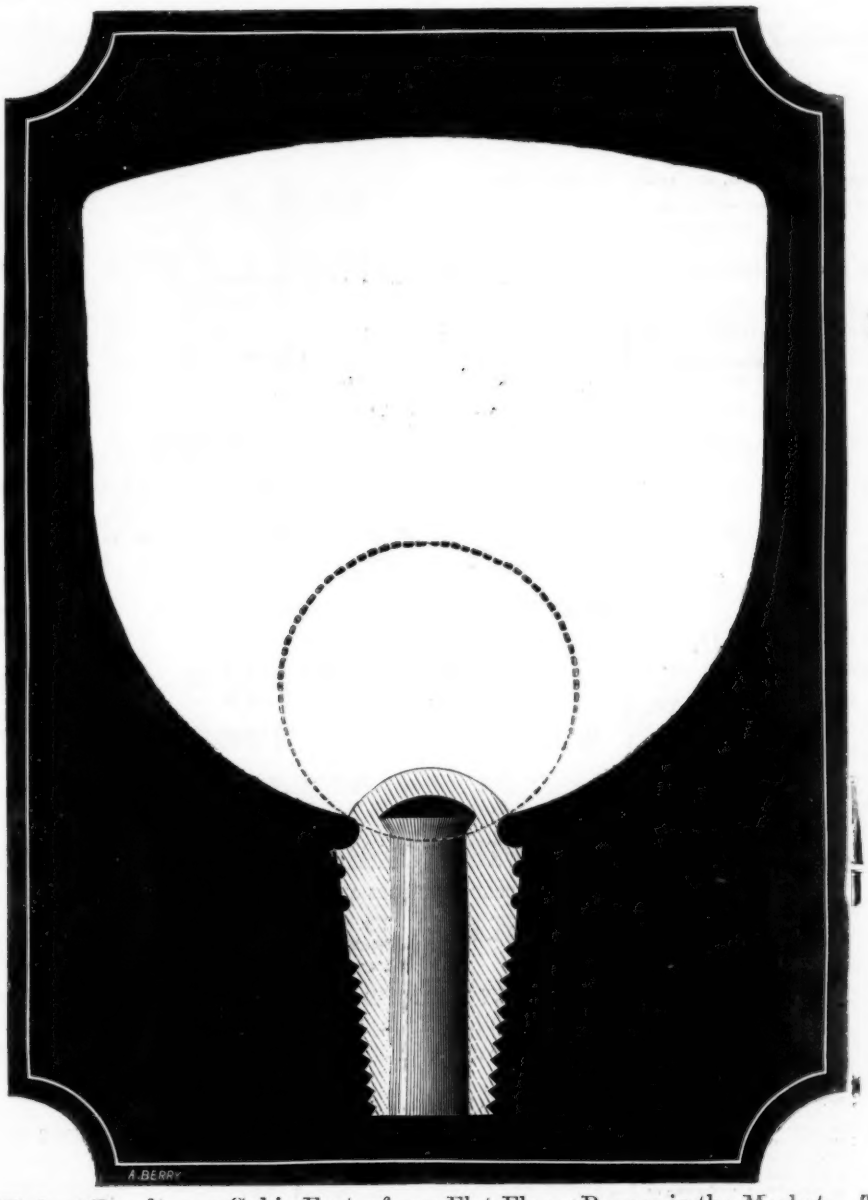

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WOOD GRIDS

FOR

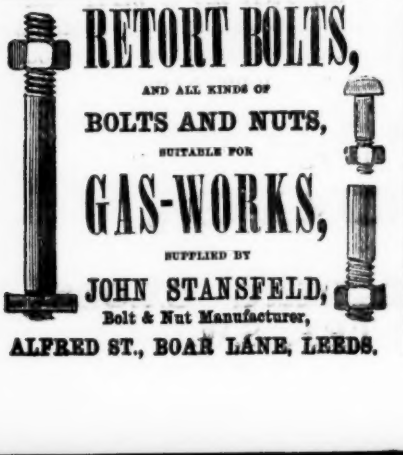
PURIFIERS AND SCRUBBERS.

BOX'S PATENT STREET GAS-LAMP

Has the following good qualities:—

1. No putty or other material is required for glazing. Thus there is no hacking out of old putty on removal of the glass, with the *consequent damage* to the lamp frames. 2. No liability to breakage by unequal expansion of the glass caused by changes of temperature. 3. Any inexperienced workman can glaze the lamp in a few minutes. 4. The system of glazing can be applied to any existing lamp at a trifling cost. 5. It is cheap, strong, and durable. 6. The glass can be easily removed so that the frames can be thoroughly painted inside and out.

The lamp may be supplied fitted with clear opal or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing lamps to this system can be supplied at moderate prices and a small charge for royalty. Licences granted on the most reasonable terms. For further particulars apply to the Patentee, W. W. BOX, Gas-Works, Crayford Kent.



RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

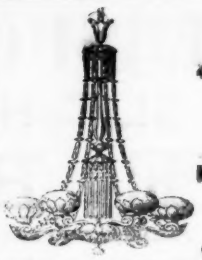
GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

Bolt & Nut Manufacturer,

ALFRED ST., BOAR LANE, LEEDS.



F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

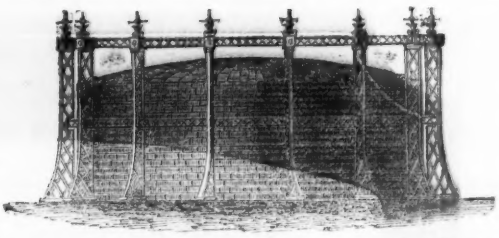
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON, E.C.,

HYDRAULIC ENGINEERS,

AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT STEAM-PUMPS,

More than 13,000 in use,

ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.

The following are some of the prominent advantages of the BLAKE PUMP:—

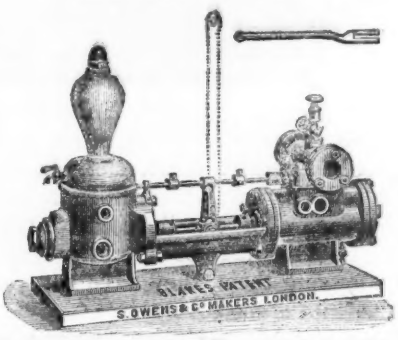
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

Upwards of 30 at The Gaslight and Coke Company's Works, Beckton.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF

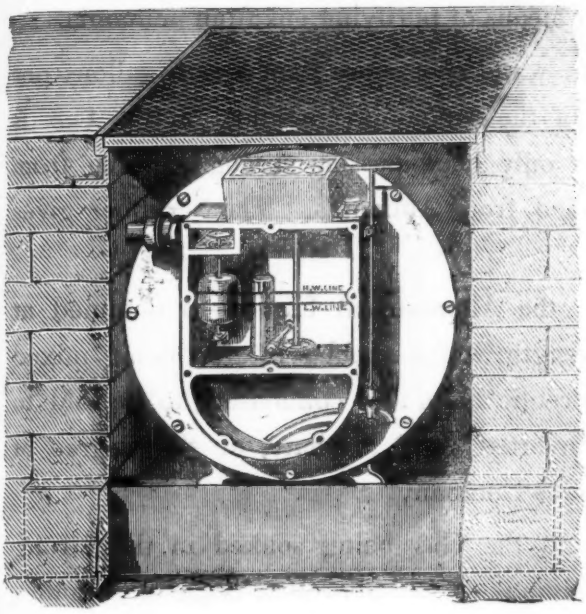
MANN & OWENS

IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

IMPROVED STREET LIGHTING.

THE necessity for having large sized Gas Lights at street crossings and other open spaces is now generally recognized. To facilitate terms for their use between Gas Companies and Lighting Authorities, we have devised a simple meter arrangement as shown.



The index faces upwards.

The inlet at side and outlet at back may be altered as desired.

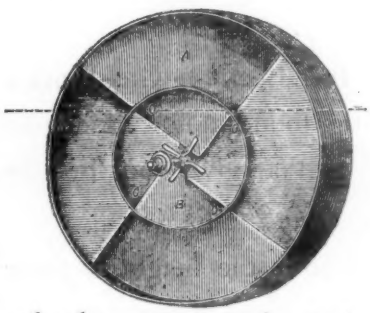
The rod with handle opens and closes the overflow tap.

The Meter case is of cast iron, and it is desirable to place it on a support 6 in. or 8 in. from bottom of tank, that it may be free from the effects of damp.

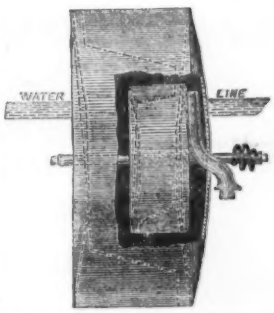
In frosty weather a little glycerine mixed with the water prevents freezing.

The Meter is fitted with

WARNER & COWAN'S
PATENT SELF-REGULATING DRUM,



which ensures correctness of registration within the water-lines shown on the illustration, while its long range of float prevents the valve being closed by vibration from traffic.



Frequent inspection is unnecessary, as the Meter need only be watered at intervals of nine to twelve months.

Dry Meters are unsuitable—the condensation which takes place inside Meters in so exposed a position interfering with their working.

Our arrangement has been in use for some time in several of the London parishes, and gives complete satisfaction.

They are made in all sizes up to 20 Lights.

PRICES AND DIMENSIONS ON APPLICATION TO

W. & B. COWAN,

(ESTABLISHED 1827,)

WET & DRY GAS-METER MANUFACTURERS,

CHURCH ST., MILLBANK ST., *LONDON, S.W.* | DUTTON ST., NEW BRIDGE ST., *MANCHESTER.* | BUCCLEUCH ST. WORKS, *EDINBURGH.*

THE MANN & WALKERS' PATENT SCRUBBER.

Extensive use.

The successful and extensive use of the Mann and Walkers' Patent Scrubbers in all parts of the world has demonstrated their advantages, and entitled them to be received with credit and confidence. The number of them in use is about twenty times that of any other known means of purifying gas from ammonia.

Small quantity of Water required.

By a very small quantity of clean water (not more than 5 or 6 gallons per ton of coals carbonized) the whole of the Ammonia contained in the Gas is completely absorbed; the Gas, after only once passing through, issuing from the Scrubber outlet completely purified from Ammonia. The Scrubber gives no appreciable back pressure.

Residual Product obtained.

The Residual Product—namely, the Ammoniacal Liquor—is obtained at from 20 to 30 ounces commercial strength, which enables it, after being mixed with the weaker Liquor from the hydraulic main and condensers, to be sold to the Manufacturing Chemists, or converted into Sulphate, at the degree of strength found most profitable to the Gas Company.

Illuminating power increased.

The Scrubber is a Saturator, and the Gas being soaked in this strong solution of Ammonia in the lower columns of the Scrubber, is purified from a large amount of Carbonic Acid, and its Illuminating Power is thereby increased.

Small amount of power required.

The friction is so little, and the motion so slow, that the power necessary to work the Scrubber is almost inappreciable. A small gas-engine will work a pair of Scrubbers, purifying 2 million cubic feet of gas per day.

Beckton Gas-Works.

There are thirty of these Patent Scrubbers in the Beckton Gas-Works, equal to purifying 30 million cubic feet per day, and the total amount of engine power necessary to work the whole 30 is not equal to that given out by one 10-horse engine.

Reserve purifying power contained.

There is also a most important advantage arising from the height of these Scrubbers, in the reserve force contained in them. In the event of any stoppage, the mass of soaked and wetted material would continue the purification for hours, even if the supply of water and working were stopped from any cause.

Internal Materials not changed.

The changing of the soaking materials in these Scrubbers is very seldom required; they are well known to remain in action for seven years without being emptied.

Guarantee

They are in all cases erected under guarantees; they easily fulfil the stipulations of any Act of Parliament, and the chemical restrictions of the Board of Trade; and in cost they are much less to a Gas Company than any other known means of purifying Gas from Ammonia.

C. & W. WALKER.

8, *Finsbury Circus, London, E.C.*

BRAY'S PATENT LANTERNS

AND

FLAT-FLAME BURNERS,

FROM 40 to 400 CANDLES POWER,

FOR

Lighting Open Spaces, Public Buildings, Railway Stations, Shop Fronts, Hotels, &c.

The understated declaration, with which we introduced our apparatus when the Argand system was in the full tide of its fame, has been fully borne out by general experience, namely—

"THE FLAT-FLAME IS THE ONLY PRACTICABLE SYSTEM FOR STREET LIGHTING; and, 'in actual use,' yields as much light with Common Gas, and more with Cannel Gas, than any Argand System."

BIRMINGHAM LAMP TESTS.

After a series of experiments, extending over more than twelve months, WITH THE MOST EXTENSIVE ASSORTMENT OF BURNERS AND LANTERNS of large lighting power ever brought together, THE BIRMINGHAM AUTHORITIES

ADOPTED BRAY'S SYSTEM

for their street-lighting improvements, for which purpose SIXTY-FIVE 100-CANDLE POWER LANTERNS of medium lighting power have been fixed, SINCE WHICH WE HAVE RECEIVED ORDERS FOR 26 MORE.

The tests showed that our 80-candle **highest** lighting power burner yielded 3·51 candles per foot of gas, which was a higher result than that yielded by any other flat-flame burner, and higher than the 80-candle power Argands.

IN THE BRITISH ASSOCIATION OF SCIENCE TESTS, 1878,

The highest results obtained by the Burners of the partie here named were:—

	Candles per Five Cub. Ft. of Gas.
Bray's Flat-flame	**28·60**
Sugg's do.	**25·56**
Sugg's Double-ring Argand	**23·33**

(*See Journal of the Society of Arts, Feb.* 7, 1879.)

The report delivered this year repeats the above UNPARALLELED TESTIMONIAL, by again placing us at the head of all flat-flame burner makers.

Note.—It will assist people's judgment if we state that the Argand system has been removed from Waterloo Place, Queen Victoria Street, Billingsgate Market, and other places in London; Sackville Street, Dublin; and Market Place, Nottingham; and that scarcely a week passes but we have applications for Burners and Lanterns TO DISPLACE THE ARGAND APPARATUS.

THE NORTH BRITISH RAILWAY (QUEEN ST.) STATION, GLASGOW, is now being lighted with 30 of BRAY'S PATENT LANTERNS.

THE NEW CALEDONIAN RAILWAY STATION, CARLISLE, is to be lighted with 107 of BRAY'S PATENT 80-CANDLE POWER GLOBULAR LANTERNS.

BRAY'S SYSTEM OF STREET LIGHTING has been adopted by the CORPORATIONS, VESTRIES, and GAS COMPANIES of nearly ALL THE LARGEST CITIES AND TOWNS IN THE UNITED KINGDOM.

PRICES AND PARTICULARS ON APPLICATION TO

GEORGE BRAY & CO., LEEDS.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

TREES BOGHEAD.

SHOTTS BOGHEAD,

And all the first-class Scotch Cannels.

Prices and Analyses on application.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 15 *candles*; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

GAS COAL.

THE MIRFIELD COAL COMPANY are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67-*candle gas, with* 1430 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

Apply to the MIRFIELD COLLIERY, Mirfield, NORMANTON. London Agent: Mr. F. J. LEE SMITH, Bromley, KENT.

HUCKNALL TORKARD CANNEL.

The HUCKNALL COLLIERY COMPANY can offer a Cannel producing a considerable quantity of Gas of good quality.

For analysis and price apply to the Company at their

HUCKNALL TORKARD COLLIERIES,

NEAR NOTTINGHAM.

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS,

LIMITED,

MANUFACTURERS OF

PATENT CLAY RETORTS,

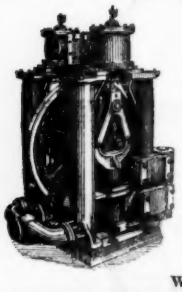
AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES,

BENDS, JUNCTIONS, &c.

Fire-Bricks, Tiles, Blocks, and Chimney-Tops.

John Cameron's Specialities



ARE HIS

PATENT LEVER

PUNCHING MACHINES

AND HIS

STEAM-PUMPS

FOR

GAS-WORKS,

Feeding Boilers, Steam Fire-Engines, Colliery Deep Lifts, Irrigation, Contractors, and Chemical purposes.

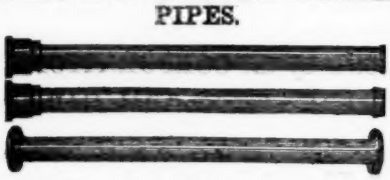
WORKS:

OLDFIELD ROAD, SALFORD, MANCHESTER

WILLIAM MACLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.



Sole Agents in Scotland for the Torbay Paint Co.

Prices on application.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES.

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

LONDONDERRY GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

For Prices and Particulars, apply to

MR. S. J. DITCHFIELD,

LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.

London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

CANNEL AND GAS COALS.

THE DUKINFIELD COAL AND CANNEL COMPANY are prepared to deliver, to any Station, their Celebrated GAS COALS, which have a very high reputation for quantity of Gas and Illuminating Power, and make a First-class Coke.

Analyses and terms of delivery may be obtained by communicating with the above Company, at their Offices,

DUKINFIELD, NEAR MANCHESTER.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

J. & H. ROBUS,

BUILDERS AND CONTRACTORS

FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,

RETORT-SETTING—A SPÉCIALITÉ.

ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.

ESTIMATES GIVEN FOR MAIN-LAYING.

N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.

Address:—J. & H. ROBUS, BELL GREEN, CATFORD, LONDON, S.E.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Twenty-Eight Illustrations and Letterpress, on the Construction of Gas-Works, will be sent, post free, on receipt of 4s. in stamps To be had of the AUTHOR; or at the Office of the "JOURNAL OF GAS LIGHTING."

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

OXIDE OF IRON

FOR THE

PURIFICATION OF GAS,

SUPPLIED DIRECT FROM THE

IRONSTONE MINES OF THE PROPRIETOR.

THIS OXIDE IS GOOD IN QUALITY AND LOW IN PRICE.

ADDRESS ALL INQUIRIES TO THE SOLE AGENT—

ALBERT USHER,

5 OFFICE, FINSBURY PARK RAILWAY STATION, LONDON, N.

NO MORE WASTE LIME! SAVE THE VALUABLE PRODUCT!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

Most Effectively and Economically restores this waste *ad infinitum*.

The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

For Terms, apply to GEO. R. HISLOP, F.C.S., Engineer, Gas-Works, PAISLEY, N.B.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

ALDWARKE MAIN AND CAR HOUSE COLLIERIES,

Near ROTHERHAM.

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD.

PROPRIETORS.

The Aldwarke Main Brights is a first-class gas-making and coking Coal, yielding by analysis 12,600 feet of 19-candle gas per ton, and giving "Weight of illuminating matter in lbs. of sperm, 820·80." It is very free from impurities and foreign matter.

Copies of Analyses made by Gas Companies who have used it will be forwarded and Samples sent on application.

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

THE WIGAN COAL & IRON COMPANY,

LIMITED.

MIDLAND DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: A. C. SCRIVENER,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

CROLL'S
DRY GAS-METERS,

PRIZE MEDALS. LONDON, 1851; NEW YORK, 1853; PARIS, 1855.

(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

MANUFACTURED ONLY BY

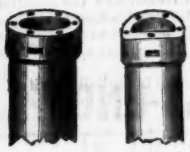
PRIZE MEDALS. LONDON, 1862; DUBLIN, 1865; PARIS, 1867.

THE GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON, N.E.

SOLE AGENT FOR SCOTLAND: JAMES KEITH, EDINBURGH AND ARBROATH.

OF IMMEDIATE IMPORTANCE TO ALL GAS FACTORIES.

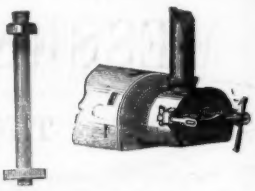


HARRIS & PEARSON, of Stourbridge, have an immense stock of **FIRE-CLAY GAS RETORTS,** all perfect and in good condition, and can supply orders of any magnitude, to any size or pattern, immediately on receipt of specification. Any Gas-Works disappointed by delay in the execution of Retort orders will do well to take advantage of this. Inspection invited.

HARRIS & PEARSON manufacture best Retort Bolts, Cast Iron Retort Mouthpieces, Fittings, and Lids, Cast Iron Gas and Water Pipes, and Connections of all Shapes and Sizes.

Glazed Bricks, white and in colours, Porcelain Baths, Fire-Clay Goods of all kinds, Hard Blue Paving Bricks for Retort Houses.

Prices, Drawings, and Specifications if desired.



Please note carefully the Address:—"HARRIS & PEARSON, STOURBRIDGE," as there are other Firms similar in name.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

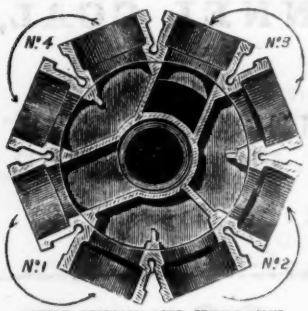
PATENT

RECESSED CONE CENTRE-VALVES,

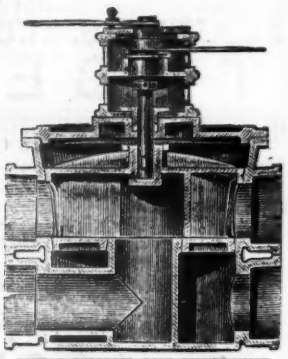
Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.



PATENT RECESSED CONE CENTRE-VALVE
Sectional Elevation.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

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